Assessment of Interstate Streams in the Susquehanna River Basin

Monitoring Report No. 13
July 1, 1998, Through June 30, 1999

Publication No. 211 *May 30, 2000*

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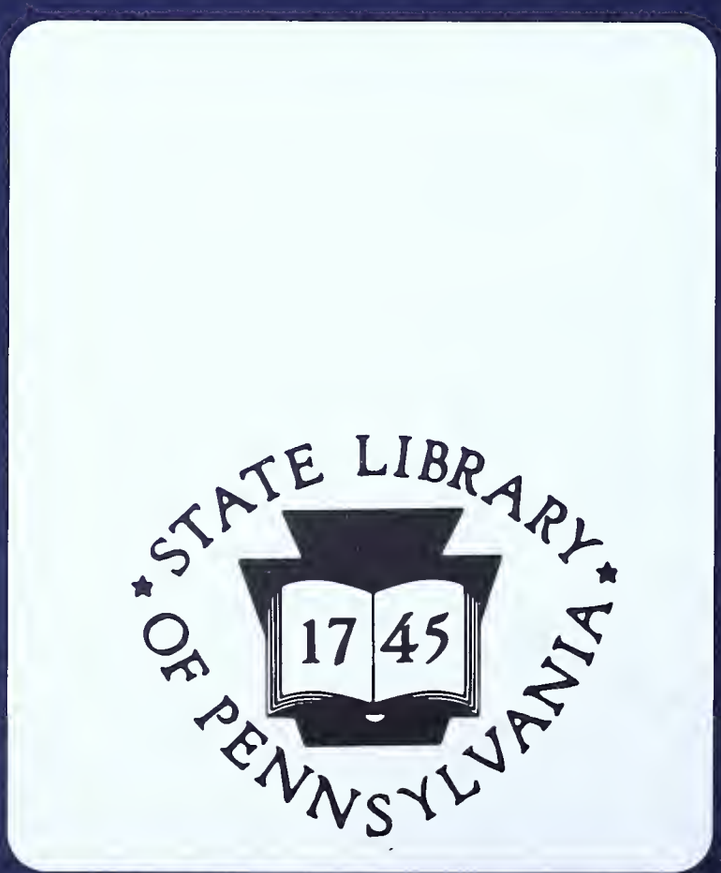
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Water Quality and Monitoring Program
Susquehanna River Basin Commission

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Darryl L. Sitlinger, Water Quality Technician

ABSTRACT

The Susquehanna River Basin Commission (SRBC) used a water quality index (WQI) and the U.S. Environmental Protection Agency's (USEPA's) Rapid Bioassessment Protocol III (RBP III) to assess the chemical water quality, biological conditions, and physical habitat of 31 sample sites in the Interstate Streams Water Quality Network from July 1, 1998, to June 30, 1999. Only 23 out of 2,228 parameter observations exceeded water quality standards. Assessment results indicate that approximately 40 percent of the sites supported nonimpaired biological communities. Water quality impacts in the New York-Pennsylvania border streams were mostly from metals, while Pennsylvania-Maryland border sites suffered from high nutrient levels.

A Seasonal Kendall Test was performed to determine trends and their magnitude for 1986-1999. Overall, decreasing trends were found for total ammonia, total phosphorus, total iron, and total manganese.

A Pearson Product Moment Correlation was performed on WQI, RBP III score, and physical habitat score. There was a significant ($p<0.05$) negative correlation between biological community and WQI scores for Pennsylvania-Maryland border sites and river sites. These relationships, while based on a small number of observations, are presented as subjects to be considered by resource managers, legislators, and local interest groups.

INTRODUCTION

One of SRBC's functions is to review projects that may have interstate impacts on water resources in the Susquehanna River Basin. SRBC established a monitoring program in 1986 to collect data that were not available from monitoring programs implemented by New York, Pennsylvania, and Maryland. The state agencies do not assess all of the interstate streams and do not produce comparable data needed to determine potential impacts on the water quality of interstate streams. SRBC's ongoing interstate monitoring program is partially funded through a grant from the USEPA.

The interstate water quality monitoring program includes periodic water and biological sampling from, as well as physical habitat assessments, of interstate streams. Water quality data are used to: (1) assess compliance with water quality standards; (2) characterize stream quality and seasonal variations; (3) build a database for assessment of water quality trends; (4) identify streams for reporting to USEPA under Section 305(b) of the Clean Water Act; (5) provide information to signatory states for 303(d) listing and possible Total Maximum Daily Load (TMDL) development; and (6) identify areas for restoration and protection. Biological conditions are assessed using benthic macroinvertebrate populations, which provide an indication of the biological health of a stream and serve as indicators of water quality. Habitat assessments provide information concerning potential stream impairment from erosion and sedimentation, as well as an indication of the stream's ability to support a healthy biological community.

SRBC's interstate monitoring program began in April 1986. For the first five years, results were reported for water years that ran from October to September. In 1991, SRBC changed the reporting periods to correspond with its fiscal year that covers the period from July to June. This report is presented for fiscal year 1999, which covers July 1, 1998, to June 30, 1999.

BASIN GEOGRAPHY

The Susquehanna River Basin is the largest river basin on the Atlantic Coast of the United States, draining 27,510 square miles. The Susquehanna River originates at the outlet of Otsego Lake, Cooperstown, N.Y., and flows 444 miles through New York, Pennsylvania, and Maryland to the Chesapeake Bay at Havre de Grace, Maryland. Eighty-three streams cross state lines in the basin (Table 1). Several streams traverse the state lines at multiple points, contributing to 91 crossings. At 45 of these locations, streams flow from New York into Pennsylvania. Twenty-two reaches cross from Pennsylvania into New York, 15 from Pennsylvania into Maryland, and nine from Maryland into Pennsylvania. Many streams are small, and 32 are unnamed.

METHODS

Field and Laboratory Methods

Sampling frequency

In Water Year 1989, the interstate streams were divided into three groups, according to the degree of water quality impairment, historical water quality impacts, and potential for degradation. These groupings were determined based on historical water quality and land use. To date, these groups remain consistent and are described below.

Streams with impaired water quality or judged to have a high potential for degradation due to large drainage areas or historical pollution were assigned to Group 1. Originally, water samples were collected from Group 1 stations every other month, except January and February. Sampling was alternated so that streams along the New York-Pennsylvania border were sampled during November, March, May, July, and September, while streams along the Pennsylvania-Maryland border were sampled during October, December, April, June, and August. During fiscal year 1999, New York-Pennsylvania streams were sampled in July, November, February, and May. Pennsylvania-Maryland stations were sampled August, November, February, and April. Benthic macroinvertebrates were collected and habitat assessments were performed in Group 1 streams during July and August 1998.

Streams judged to have a moderate potential for impacts were assigned to Group 2. Water quality samples, benthic macroinvertebrate samples, and physical habitat information were obtained from Group 2 stations once a year, preferably during base flow conditions in the summer months. In this sampling period, water chemistry, macroinvertebrate, and physical habitat information were collected during July and August 1998.

Streams judged to have a low potential for impacts were assigned to Group 3. These stations were not sampled but were visually inspected for signs of degradation once a year. New York-Pennsylvania border and Pennsylvania-Maryland border stream stations sampled during fiscal year 1999 are listed in Tables 2 and 3, respectively, and are depicted in Figures 1 through 4.

Stream discharge

Stream discharge was measured at all stations unless high streamflows made access impossible. Several stations are located near U.S. Geological Survey (USGS) stream gages. These stations include the following: the Susquehanna River at Windsor, N.Y., Kirkwood, N.Y., Sayre, Pa., Marietta, Pa., and Conowingo, Md.; the Chemung River at Chemung, N.Y.; the Tioga River at Lindley, N.Y.; and the Cowanesque River at Lawrenceville, Pa. Recorded stages from USGS gaging stations and rating curves were used to determine instantaneous discharges in cubic feet per second (cfs). Instantaneous discharges for stations not located near USGS gaging stations

Table 1. Interstate Streams in the Susquehanna River Basin

Stream Name	Monitoring Group*	Flow Direction (from→to)
Streams Along the New York–Pennsylvania Border		
Apalachin Creek	2	Pa.→ N.Y.
Babcock Run	3	N.Y.→ Pa.
Bentley Creek	2	Pa.→ N.Y.
Bill Hess Creek	3	N.Y.→Pa.
Bird Creek	3	Pa.→N.Y.
Biscuit Hollow	3	N.Y.→Pa.
Briggs Hollow Run	3	N.Y.→Pa.
Bulkley Brook	3	N.Y.→Pa.
Camp Brook	3	N.Y.→Pa.
Cascade Creek	2	N.Y.→Pa.
Cayuta Creek	1	N.Y.→Pa.
Chemung River	1	N.Y.→Pa.→N.Y.→Pa.
Choconut Creek	2	Pa.→ N.Y.
Cook Hollow	3	N.Y.→Pa.
Cowanesque River	1	Pa.→ N.Y.
Deep Hollow Brook	3	N.Y.→Pa.
Denton Creek	3	N.Y.→Pa.
Dry Brook	3	N.Y.→Pa.
Holden Creek	2	N.Y.→Pa.
Little Snake Creek	2	Pa.→ N.Y.
Little Wappasening Creek	3	Pa.→ N.Y.
North Fork Cowanesque River	2	N.Y.→Pa.
Parks Creek	3	Pa.→ N.Y.
Prince Hollow Run	3	N.Y.→Pa.
Red House/Beagle Hollow	3	N.Y.→Pa.
Russell Run	3	N.Y.→Pa.
Sackett Creek	3	Pa.→ N.Y.
Seeley Creek	2	Pa.→ N.Y.
South Creek	2	Pa.→ N.Y.
Snake Creek	2	Pa.→ N.Y.
Strait Creek	3	N.Y.→Pa.
Susquehanna River	1	N.Y.→Pa.→N.Y.→Pa.
Tioga River	1	Pa.→ N.Y.
Troups Creek	1	N.Y.→Pa.
Trowbridge Creek	2	N.Y.→Pa.
Wappasening Creek	2	Pa.→ N.Y.
White Branch	3	N.Y.→Pa.
White Hollow	3	Pa.→ N.Y.
17 Unnamed tributaries	3	N.Y.→Pa.
2 Unnamed tributaries	3	Pa.→ N.Y.
2 Unnamed tributaries	3	Pa.→ N.Y.→Pa.
1 Unnamed tributary	3	N.Y.→Pa.→N.Y.

Table 1. Interstate Streams in the Susquehanna River Basin—Continued

Stream Name	Monitoring Group*	Flow Direction (from→to)
Streams Along the Pennsylvania–Maryland Border		
Big Branch Deer Creek	2	Pa.→Md.
Conowingo Creek	1	Pa.→Md.
Deer Creek	1	Pa.→Md.
Ebaughs Creek	1	Pa.→Md.
Falling Branch Deer Creek	2	Pa.→Md.
Island Branch	3	Pa.→Md.
Long Arm Creek	2	Md.→Pa.
Octoraro Creek	1	Pa.→Md.
Scott Creek	1	Md.→Pa.
South Branch Conewago Creek	2	Md.→Pa.
Susquehanna River	1	Pa.→Md.
6 Unnamed tributaries	3	Md.→Pa.
7 Unnamed tributaries	3	Pa.→Md.

* Group 1 streams are sampled quarterly, Group 2 streams are sampled annually, and Group 3 streams are not sampled.

Table 2. Stream Stations Sampled Along the New York–Pennsylvania Border and Sampling Rationale

Station	Stream and Location	Monitoring Group*	Rationale
CASC 1.6	Cascade Creek Lanesboro, Pa.	2	Monitor for potential water quality impacts
TROW 1.8	Trowbridge Creek, Great Bend, Pa.	2	Monitor for potential water quality impacts
SNAK 2.3	Snake Creek, Brookdale, Pa.	2	Monitor for potential water quality impacts
LSNK 7.6	Little Snake Creek, Brackney, Pa.	2	Monitor for potential water quality impacts
CHOC 9.1	Choconut Creek, Vestal Center, N.Y.	2	Monitor for potential water quality impacts
APAL 6.9	Apalachin Creek, Little Meadows, Pa.	2	Monitor for potential water quality impacts
WAPP 2.6	Wappasening Creek, Nichols, N.Y.	2	Monitor for potential water quality impacts
CAYT 1.7	Cayuta Creek, Waverly, N.Y.	1	Municipal discharge from Waverly, N.Y.
BNTY 0.9	Bentley Creek, Wellsburg, N.Y.	2	Monitor for potential water quality impacts
SOUT 7.8	South Creek, Fassett, Pa.	2	Monitor for potential water quality impacts
SEEL 10.3	Seeley Creek, Seeley Creek, N.Y.	2	Monitor for potential water quality impacts
HLDN 3.5	Holden Creek, Woodhull, N.Y.	2	Monitor for potential water quality impacts
TRUP 4.5	Troups Creek, Austinburg, Pa.	1	High turbidity and moderately impaired macroinvertebrate populations
NFCR 7.6	North Fork Cowanesque River, North Fork, Pa.	2	Monitor for potential water quality impacts
SUSQ 365.0	Susquehanna River, Windsor, N.Y.	1	Large drainage area (1,882 sq. mi.); municipal discharges from Cooperstown, Sidney, Bainbridge, and Oneonta
SUSQ 340.0	Susquehanna River, Kirkwood, N.Y.	1	Large drainage area (2,232 sq. mi.); historical pollution due to sewage from Lanesboro, Oakland, Susquehanna, Great Bend, and Hallstead
SUSQ 289.1	Susquehanna River, Sayre, Pa.	1	Large drainage area (4,933 sq. mi.); municipal and industrial discharges
CHEM 12.0	Chemung River, Chemung, N.Y.	1	Municipal and industrial discharges from Elmira, N.Y.
TIOG 10.8	Tioga River, Lindley, N.Y.	1	Pollution from acid mine discharges and impacts from flood control reservoirs
COWN 2.2	Cowanesque River, Lawrenceville, Pa.	1	Impacts from flood control reservoir

* Group 1 streams are sampled quarterly and Group 2 streams are sampled annually

Table 3. Stream Stations Sampled Along the Pennsylvania–Maryland Border and Sampling Rationale

Station	Stream and Location	Monitoring Group*	Rationale
LNGA 2.5	Long Arm Creek, Bandanna, Pa.	2	Monitor for potential water quality impacts
SBCC 20.4	South Branch Conewago Creek, Bandanna, Pa.	2	Monitor for potential water quality impacts
DEER 44.2	Deer Creek, Gorsuch Mills, Md.	1	Past pollution from Gorsuch Mills, Md., Stewartstown, Pa.; Nonpoint runoff to Chesapeake Bay
EBAU 1.5	Ebaughs Creek, Stewartstown, Pa.	1	Municipal discharge from Stewartstown, Pa.; Nonpoint runoff to Chesapeake Bay
SCTT 3.0	Scott Creek, Delta, Pa.	1	Pollution from untreated sewage
BBDC 4.1	Big Branch Deer Creek, Fawn Grove, Pa.	2	Monitor for potential water quality impacts
FBDC 4.1	Falling Branch Deer Creek, Fawn Grove, Pa.	2	Monitor for potential water quality impacts
CNWG 4.4	Conowingo Creek, Pleasant Grove, Pa.	1	High nutrient loads and other agricultural runoff; Nonpoint runoff to Chesapeake Bay
OCTO 6.6	Octoraro Creek, Rising Sun, Md.	1	High nutrient loads due to agricultural runoff from New Bridge, Md.; Water quality impacts from Octoraro Lake; Nonpoint runoff to Chesapeake Bay
SUSQ 44.5	Susquehanna River, Marietta, Pa.	1	Bracket hydroelectric dams near the state line
SUSQ 10.0	Susquehanna River, Conowingo, Md.	1	Bracket hydroelectric dams near the state line

* Group 1 streams are sampled quarterly and Group 2 streams are sampled annually

Figure 1. Interstate Streams Along the New York-Pennsylvania Border Between Apalachin Creek and Cascade Creek

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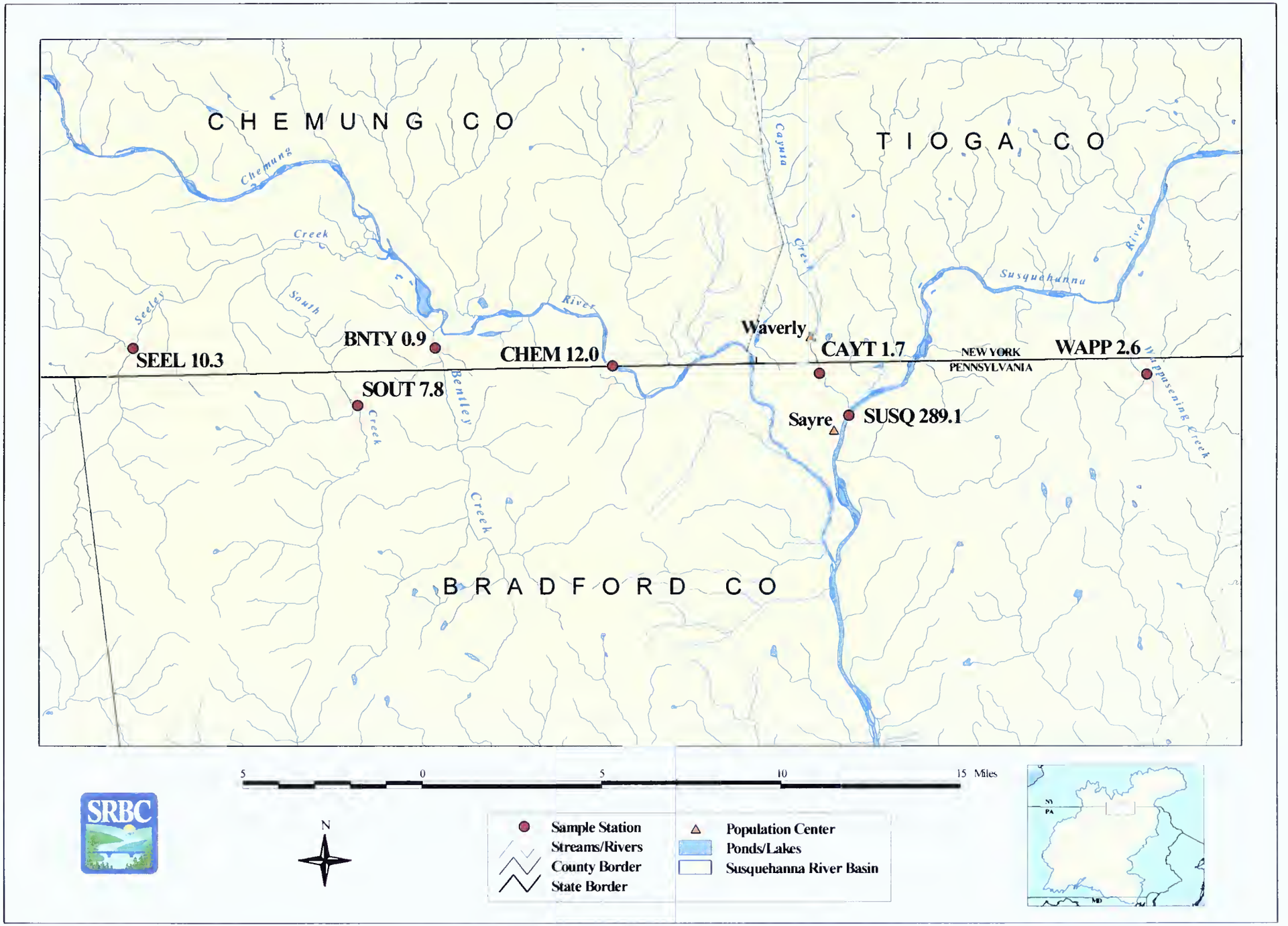

Figure 2. Interstate Streams Along the New York-Pennsylvania Border Between Seeley Creek and Wappasening Creek

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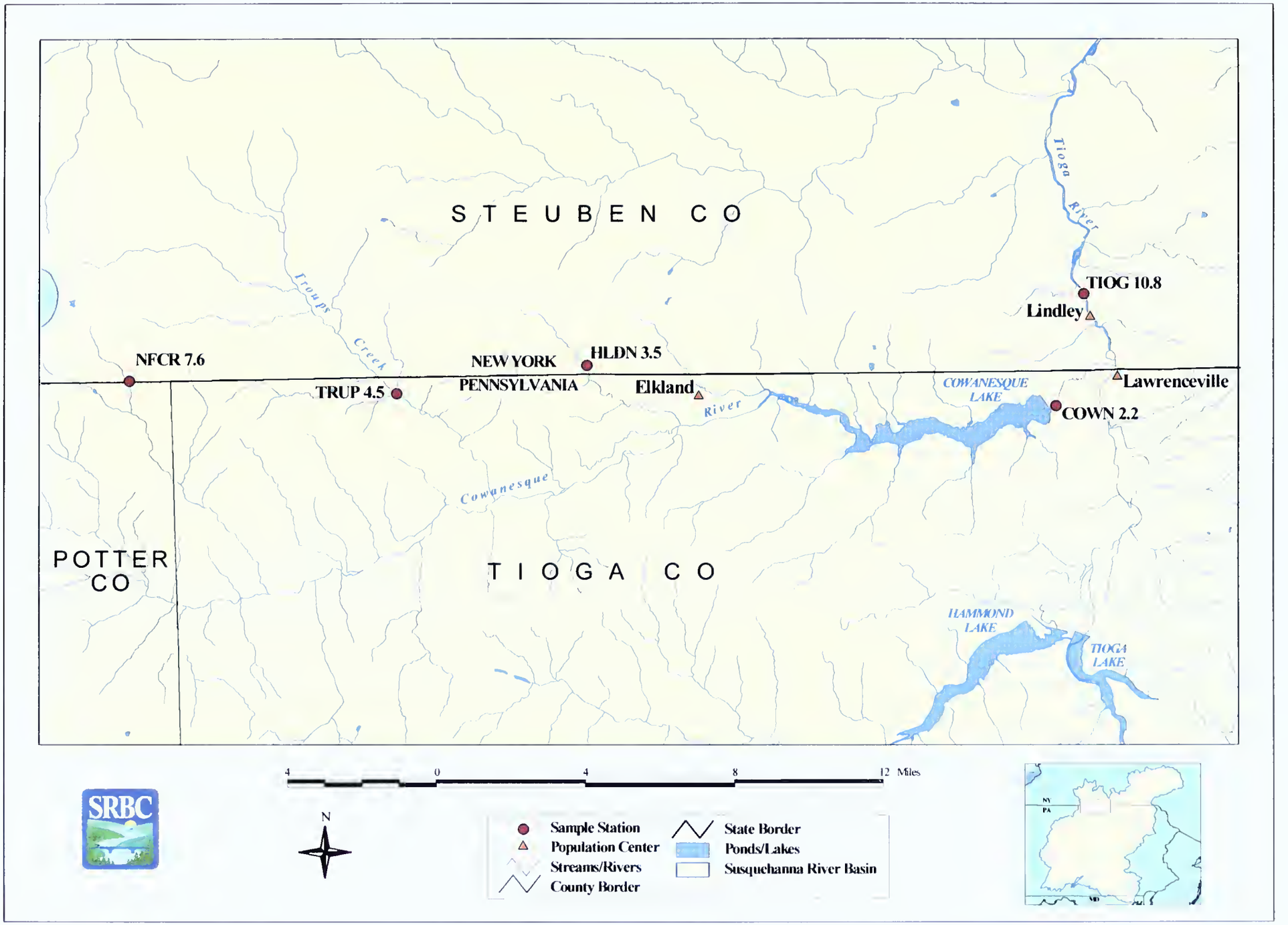

Figure 3. Interstate Streams Along the New York-Pennsylvania Border Between North Fork Cowanesque River and Tioga River

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Figure 4. Interstate Sreams Along the Pennsylvania-Maryland Border

were measured at the time of sampling, using standard USGS procedures. Stream discharges are tabulated according to station name and date in Appendix A.

Water samples

Water samples were collected at each of the sites to measure nutrient and metal concentrations. Chemical and physical parameters monitored are listed in Table 4. Water samples were collected using a depth-integrating sampler. Composite samples were obtained by collecting eight depth-integrated samples across the stream channel and combining them in a churn splitter that was previously rinsed with distilled water. Water samples were thoroughly mixed in the churn splitter and collected in 250-milliliter (ml) bottles. One whole water sample and one filtered sample were collected for nutrient analysis. A whole water sample and a filtered sample were collected in acid-rinsed bottles and fixed with concentrated nitric acid (HNO_3) for metal analysis. A cellulose nitrate filter with 0.45-micron pore size was used to obtain the filtrate for laboratory analysis. The samples were chilled on ice and sent to the Pennsylvania Department of Environmental Protection (Pa. DEP), Bureau of Laboratories in Harrisburg, Pa., within 24 hours of collection.

Field chemistry

Temperature, dissolved oxygen, conductivity, pH, alkalinity, and acidity were measured in the field. Dissolved oxygen was measured using a YSI model 55 dissolved oxygen meter that was calibrated at the beginning of each day when water samples were collected. A VWR Scientific Model 2052 conductivity meter was used to measure conductivity. A Cole Parmer meter was used to measure pH. The pH meter was calibrated at the beginning of the day and randomly checked throughout the day. Alkalinity was determined by titrating a known volume of water to pH 4.5 with 0.02 N sulfuric acid (H_2SO_4). Acidity was measured by titrating a known volume of sample water to pH 8.3 with 0.02N sodium hydroxide (NaOH).

Macroinvertebrate and physical habitat sampling

SRBC staff collected benthic macro-invertebrate samples from Group 1 and Group 2 stations between July 27 and August 6, 1998. The benthic macroinvertebrate community was sampled to provide an indication of the biological condition of each stream. Macroinvertebrates are defined as aquatic insects and other invertebrates too large to pass through a No. 30 sieve.

Benthic macroinvertebrate samples were analyzed using field and laboratory methods described in Rapid Bioassessment Protocol for Use in Streams and Rivers by Plafkin and others (1989). Sampling was performed using a 1-meter-square kick screen with size No. 30 mesh. The kick screen was stretched across the current to collect organisms dislodged from riffle/run areas by physical agitation of the stream substrate. Two kick screen samples were collected from a representative riffle/run at each station. The two samples were composited and preserved in isopropyl alcohol for later laboratory analysis.

In the laboratory, composite samples were sorted into 100-organism subsamples using a gridded pan and a random numbers table. The organisms contained in the subsamples were identified to genus (except Chironomidae) and enumerated. Each taxon was assigned an organic pollution tolerance value and a functional feeding category as outlined in Appendix B. A taxa list for each station can be found in Appendix C.

Physical habitat conditions at each station were assessed using a slightly modified version of the habitat assessment procedure outlined by Plafkin and others (1989). Eleven habitat parameters were field-evaluated at each site and used to calculate a site-specific habitat assessment score. Habitat parameters were identified as primary, secondary, or tertiary parameters, based on their contribution to habitat quality. Primary parameters, stream habitat features that have the greatest direct influence on the structure of aquatic macroinvertebrate communities, were evaluated on a scale of 0 to 20 and included stream bottom substrate and instream cover,

Table 4. Monitored Parameters

Parameter	STORET Code
Physical	
Discharge	00060
Temperature	00010
Chemical	
Field Analyses	
Conductivity	00095
Dissolved Oxygen	00300
pH	00400
Alkalinity	00410
Acidity	00435
Laboratory Analyses	
Solids, Dissolved	00515
Solids, Total	00500
Ammonia as Nitrogen, Dissolved	00608
Ammonia as Nitrogen, Total	00610
Nitrite as Nitrogen, Dissolved	00613
Nitrite as Nitrogen, Total	00615
Nitrate as Nitrogen, Dissolved	00618
Nitrate as Nitrogen, Total	00620
Phosphorus, Dissolved	00666
Phosphorus, Total	00665
Orthophosphate, Dissolved	00671
Orthophosphate, Total	70507
Organic Carbon, Total	00680
Calcium, Total	00916
Magnesium, Total	00927
Chloride, Total	00940
Sulfate, Total	00945
Iron, Dissolved	01046
Iron, Total	01045
Manganese, Dissolved	01056
Manganese, Total	01055
Aluminum, Dissolved	01106
Aluminum, Total	01105
Turbidity	82079

embeddedness, and velocity/depth diversity. Secondary parameters included stream channel morphology characteristics, such as pool/riffle ratio, pool quality, riffle/run quality, and channel alteration, and were scored on a scale of 0 to 15. Tertiary parameters, such as streambank erosion, streambank stability, streamside vegetative cover, and riparian buffer zone width, characterized riparian and bank conditions and were scored on a scale of 0 to 10. Table 5 summarizes criteria used to evaluate habitat parameters.

Data Synthesis Methods

Chemical water quality

Results of laboratory analysis for chemical parameters were compared to New York, Pennsylvania, and Maryland State water quality standards. In addition, a simple WQI was calculated, using procedures established by McMorran and Bollinger (1990). The WQI was used to make comparisons between sampling periods and stations within the same geographical region; therefore, the water quality data were divided into two groups. One group contained stations along the New York-Pennsylvania border, and the other group contained stations along the Pennsylvania-Maryland border. The data in each group were sorted by parameter and ranked by increasing order of magnitude, with several exceptions. Dissolved oxygen and alkalinity were ranked by decreasing order of magnitude, while pH and acidity were not factored into the percentile scores. The rank of each chemical analysis was divided by the total number of observations in the group to obtain a percentile. The WQI score was calculated by averaging all percentile ranks for each sample. Water quality index scores range from 1 to 100, and high WQI scores indicate poor water quality. Water quality scores and a list of parameters exceeding standards for each site can be found in the "Bioassessment of Interstate Streams" section, beginning on page 44.

Reference category designations

Three reference sites were included in this study. These three sites represented the best available suite of conditions, in terms of habitat and biological community, for each of the categories. The Susquehanna River (SUSQ 289.1) at Sayre, Pa., was used as the reference site for all of the Susquehanna River main stem samples, as well as for Cowanesque River, Chemung River, and Tioga River sites. Sites located on the New York-Pennsylvania border were compared to Snake Creek (SNAK 2.3) at Brookdale, Pa. Snake Creek represented the best biological and habitat conditions in the Northern Appalachian Plateau and Uplands Ecoregion. Big Branch Deer Creek (BBDC 4.1) near Fawn Grove, Pa., served as the reference site for sampling stations located on the Pennsylvania-Maryland border. Big Branch Deer Creek had the best biological and habitat conditions in the Northern Piedmont Ecoregion (Omernik, 1987).

Biological and physical habitat conditions

Benthic macroinvertebrate samples were assessed using procedures described by Plafkin and others (1989). Using this method, staff calculated a series of biological indexes for each stream and compared them to indexes for a nonimpaired reference station in the same region to determine the degree of impairment. The metrics used in this survey are summarized in Table 6. Metrics 1 and 3 through 8 were taken directly from Plafkin and others (1989). Metric 2 (Shannon Diversity Index) was substituted for the recommended ratio of shredders to total macroinvertebrates, which required specialized sampling procedures.

The 100-organism subsample data were used to generate scores for each of the eight metrics. Each metric score was then converted to a biological condition score, based on the percent similarity of the metric score, relative to the metric score for the reference site. The sum of the biological condition scores constituted the total biological score for the sample site, and total biological scores were used to assign each site to a biological condition category (Table 7). Habitat assessment scores of sample sites were compared to those of reference sites to assign each sample site to a habitat condition category (Table 8).

Table 5. Criteria Used to Evaluate Physical Habitat

Habitat Parameter	Excellent	Good	Fair	Poor
1 **Bottom Substrate**	Greater than 50% cobble, gravel, submerged logs, undercut banks, or other stable habitat. **(16-20)**	30-50% cobble, gravel, or other stable habitat. Adequate habitat. **(11-15)**	10-30% cobble, gravel, or other stable habitat. Habitat availability is less than desirable. **(6-10)**	Less than 10% cobble, gravel, or other stable habitat. Lack of habitat is obvious. **(0-5)**
2 **Embeddedness (a)**	Larger substrate particles (e.g., gravel, cobble, boulders) are between 0 and 25% surrounded by fine sediment. **(16-20)**	Larger substrate particles (e.g., gravel, cobble, boulders) are between 25 and 50% surrounded by fine sediment. **(11-15)**	Larger substrate particles (e.g., gravel, cobble, boulders) are between 50 and 75% surrounded by fine sediment. **(6-10)**	Larger substrate particles (e.g., gravel, cobble, boulders) are over 75% surrounded by fine sediment. **(0-5)**
3 **Velocity/Depth Diversity**	Four habitat categories consisting of slow (<1.0 ft/s), deep (>1.5 ft); slow, shallow (<1.5 ft); fast (> 1.0 ft/s), deep; fast, shallow habitats are all present. **(16-20)**	Only three of the four habitat categories are present. **(11-15)**	Only two of the four habitat categories are present. **(6-10)**	Dominated by one velocity/depth category (usually pools). **(0-5)**
4 **Pool/Riffle Ratio (or Run/Bend)**	Distance between riffles divided by mean wetted width equals 5-7. Stream contains a variety of habitats including deep riffles and pools. **(12-15)**	Distance between riffles divided by mean wetted width equals 7-15. Adequate depth in pools and riffles. **(8-11)**	Distance between riffles divided by mean wetted width equals 15-25. Stream contains occasional riffles. **(4-7)**	Distance between riffles divided by mean wetted width >25. Stream is essentially straight with all flat water or shallow riffle. Poor habitat. **(0-3)**
5 **Pool Quality (b)**	Pool habitat contains both deep (>1.5 ft) and shallow areas (<1.5 ft) with complex cover and/or depth greater than 5 ft. **(12-15)**	Pool habitat contains both deep (>1.5 ft) and shallow (<1.5 ft) areas with some cover present. **(8-11)**	Pool habitat consists primarily of shallow (<1.5 ft) areas with little cover. **(4-7)**	Pool habitat rare with maximum depth <0.5 ft, or pool habitat absent completely. **(0-3)**
6 **Riffle/Run Quality (c)**	Riffle/run depth generally >8 in. and consisting of stable substrate materials and a variety of current velocities. **(12-15)**	Riffle/run depth generally 4-8 in. and with a variety of current velocities. **(8-11)**	Riffle/run depth generally 1-4 in.; primarily a single current velocity. **(4-7)**	Riffle/run depth <1 in.; or riffle/run substrates concreted. **(0-3)**
7 **Channel Alteration (d)**	Little or no enlargement of islands or point bars, and/or no channelization. **(12-15)**	Some new increase in bar formation, mostly from coarse gravel; and/or some channelization present. **(8-11)**	Moderate deposition of new gravel, coarse sand on old and new bars; pools partially filled with silt; and/or embankments on both banks. **(4-7)**	Heavy deposits of fine material, increased bar development; most pools filled with silt; and/or extensive channelization. **(0-3)**

Table 5. Criteria Used to Evaluate Physical Habitat—Continued

Habitat Parameter	Excellent	Good	Fair	Poor
8. **Upper and Lower Streambank Erosion (e)**	Stable. No evidence of erosion or of bank failure. Side slopes generally <30%. Little potential for future problems. **(9-10)**	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. **(6-8)**	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% in some areas. High erosion potential during extreme high flow. **(3-5)**	Unstable. Many eroded areas. Side slopes >60% common. "Raw" areas frequent along straight sections and bends. **(0-2)**
9. **Upper and Lower Streambank Stability (e)**	Over 80% of the streambank surface is covered by vegetation or boulders and cobble. **(9-10)**	50-79% of the streambank surface is covered by vegetation, gravel, or larger material. **(6-8)**	25-49% of the streambank surface is covered by vegetation, gravel, or larger material. **(3-5)**	Less than 25% of the streambank surface is covered by vegetation, gravel, or larger material. **(0-2)**
10. **Streamside Vegetative Cover *(Both Banks)***	Dominant vegetation that provides stream shading, escape cover, and/or refuge for fish within the bankfull stream channel is shrub. **(9-10)**	Dominant vegetation that provides stream shading, escape cover, and/or refuge for fish within the bankfull stream channel is trees. **(6-8)**	Dominant vegetation that provides stream shading, escape cover, and/or refuge for fish within the bankfull stream channel is forbs and grasses. **(3-5)**	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. **(0-2)**
11. **Forested Riparian Buffer Zone Width (f) *(Least Forested Bank)***	Riparian area consists of all three zones of vegetation, Zones 1-3. (See zone descriptions (f)). **(9-10)**	Riparian area consists of Zones 1 and 2. **(6-8)**	Riparian area is limited primarily to Zone 1. Zone 2 may be forested but is subject to disturbance (e.g. grazing, intensive forestry practices, roads). **(3-5)**	Riparian area lacks Zone 1 with or without Zones 2 and/or 3. **(0-2)**

(a) Embeddedness — The degree to which the substrate materials that serve as habitat for benthic macroinvertebrates and for fish spawning and egg incubation (predominantly cobble and/or gravel) are surrounded by fine sediment. Embeddedness is evaluated with respect to the suitability of these substrate materials as habitat for macroinvertebrates and fish by providing shelter from the current and predators, and by providing egg deposition and incubation sites.

(b) Pool Quality — Rated based on the variety and spatial complexity of slow- or still-water habitat within the sample segment. It should be noted that even in high- gradient segments, functionally important slow-water habitat may exist in the form of plunge-pools and/or larger eddies. Within a category, higher scores are assigned to segments that have undercut banks, woody debris, or other types of cover for fish.

(c) Riffle/Run Quality — Rated based on the depth, complexity, and functional importance of riffle/run habitat in the segment, with highest scores assigned to segments dominated by deeper riffle/run areas, stable substrates, and a variety of current velocities.

(d) Channel Alteration — A measure of large-scale changes in the shape of the stream channel. Channel alteration includes: concrete channels, artificial embankments, obvious straightening of the natural channel, rip-rap, or other structures, as well as recent sediment bar development. Sediment bars typically form on the inside of bends, below channel constrictions, and where stream gradient decreases. Bars tend to increase in depth and length with continued watershed disturbance. Ratings for this metric are based on the presence of artificial structures as well as the existence, extent, and coarseness of sediment bars, which indicate the degree of flow fluctuations and substrate stability.

(e) Upper and Lower Streambank Erosion and Stability — These parameters include the concurrent assessment of both the upper and lower banks. The upper bank is the land area from the break in the general slope of the surrounding land to the top of the bankfull channel. The lower bank is the intermittently submerged portion of the stream cross section from the top of the bankfull channel to the existing waterline.

(f) Forested Riparian Buffer Zone Width
- Zone 1: a 15 ft wide buffer of essentually undisturbed forest located immediately adjacent to the stream.
- Zone 2: a 100-ft-wide buffer of forest, located adjacent to Zone 1, which may be subject to non-intensive forest management practices.
- Zone 3: a 20-ft-wide buffer of vegetation, located adjacent to Zone 2, that provides sediment filtering and promotes the formation of sheet flow runoff into Zone 2. Zone 3 may be composed of trees, shrubs, and/or dense grasses and forbs, which are subject to haying and grazing, as of as long as vegetation is maintained in vigorous condition.

Source: Modified from Plafkin and others, 1989.

Table 6. Summary of Metrics Used to Evaluate the Overall Biological Integrity of Stream and River Benthic Macroinvertebrate Communities

Metric	Description
1. Taxonomic Richness (a)	The total number of taxa present in the 100 organism subsample
2. Shannon Diversity Index (b)	A measure of biological community complexity based on the number of equally or nearly equally abundant taxa in the community
3. Hilsenhoff Biotic Index (a)	A measure of the overall pollution tolerance of a benthic macroinvertebrate community
4. EPT Index (a)	The total number of Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) taxa present in the 100 organism subsample
5. Ratio of Scrapers/Filterers (a)	A reflection of the riffle/run community foodbase and an insight into the nature of potential disturbance factors
6. Ratio of EPT/Chironomids (a)	A measure of community balance and indicator of environmental stress
7. Community Loss Index (a)	A measure of loss of benthic taxa between a reference station and the station of comparison
8. Percent Dominant Taxa (a)	A measure of community balance at the lowest positive taxonomic level

Sources (a) Plafkin and others (1989); and
(b) calculated using software developed by Kovach (1993)

Table 7. Summary of Criteria Used to Classify the Biological Conditions of Sample Sites

SAMPLING AND ANALYSIS

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TOTAL BIOLOGICAL SCORE DETERMINATION				
	Biological Condition Scoring Criteria			
Metric	6	4	2	0
1. Taxonomic Richness (a)	>80 %	79 – 60 %	59 – 40 %	<40 %
2. Shannon Diversity Index (a)	>75 %	74 – 50 %	49 – 25 %	<25 %
3. Modified Hilsenhoff Biotic Index (b)	>85 %	84 – 70 %	69 – 50 %	<50 %
4. EPT Index (a)	>90 %	89 – 80 %	79 – 70 %	<70 %
5. Ratio Scrapers/Filterers (a, c)	>50 %	49 – 35 %	34 – 20 %	<20 %
6. Ratio EPT/Chironomids (a)	>75 %	74 – 50 %	49 – 25 %	<25 %
7. Community Loss Index (d)	<0.5	0.5 – 1.5	1.5 – 4.0	>4.0
8. Percent Dominant Taxa (e)	<20 %	20 – 30 %	31 – 40 %	>40 %
Total Biological Score (f)				

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BIOASSESSMENT	
Percent Comparability of Study and Reference Site Total Biological Scores (g)	Biological Condition Category
>83	Nonimpaired
79 - 54	Slightly Impaired
50 - 21	Moderately Impaired
<17	Severely Impaired

(a) Score is study site value/reference site value X 100.
(b) Score is reference site value/study site value X 100.
(c) Determination of Functional Feeding Group is independent of taxonomic grouping
(d) Range of values obtained. A comparison to the reference station is incorporated in these indexes.
(e) Scoring criteria evaluate actual percent contribution, not percent comparability to the reference station.
(f) Total Biological Score = the sum of Biological Condition Scores assigned to each metric.
(g) Values obtained that are intermediate to the indicated ranges will require subjective judgment as to the correct placement into a biological condition category.

Table 8. Summary of Criteria Used to Classify the Habitat Conditions of Sample Sites

DETERMINATION OF HABITAT ASSESSMENT SCORES				
Parameter	Habitat Parameter Scoring Criteria			
	Excellent	Good	Fair	Poor
Bottom Substrate	20-16	15-11	10-6	5-0
Embeddedness	20-16	15-11	10-6	5-0
Velocity/Depth Diversity	20-16	15-11	10-6	5-0
Pool-Riffle (Run-Bend) Ratio	15-12	11-8	7-4	3-0
Pool Quality	15-12	11-8	7-4	3-0
Riffle/Run Quality	15-12	11-8	7-4	3-0
Channel Alteration	15-12	11-8	7-4	3-0
Upper and Lower Streambank Erosion	10-9	8-6	5-3	2-0
Upper and Lower Streambank Stability	10-9	8-6	5-3	2-0
Streamside Vegetative Cover	10-9	8-6	5-3	2-0
Forested Riparian Buffer Zone Width	10-9	8-6	5-3	2-0
Habitat Assessment Score (a)				

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HABITAT ASSESSMENT	
Percent Comparability of Study and Reference Site Habitat Assessment Scores	Habitat Condition Category
>90	Excellent (comparable to reference)
89-75	Supporting
74-60	Partially Supporting
<60	Nonsupporting

(a) Habitat Assessment Score = Sum of Habitat Parameter Scores

Trend analysis

A long-term trend has been defined as a steady increase or decrease of a variable over time, as opposed to a change (step trend), which is a sudden difference in water quality associated with an event (Bauer and others, 1984). As the interstate streams data are not useful for analyzing step trends due to large drainage areas and insufficient information about discharges, only long-term trends were included in this study. Trends analysis was performed on all Group 1 streams (see Table 1) for the following parameters: total suspended solids; total ammonia; total nitrogen; total phosphorus; total chloride; total sulfate; total iron; total aluminum; total manganese; and water quality index. The period covered for the trends analysis was April 1986 through June 1999.

The nonparametric trend test used in this study was the Seasonal Kendall Test, which is described by Bauer and others (1984) and Smith and others (1982). The Seasonal Kendall Test was used to detect the presence or absence of monotonic trends in the parameters described above. This test is useful for testing trends of quarterly water quality samples with seasonal variability, because seasonality is removed by comparing data points only within the same quarter for all years in the data set. Outliers also do not present a problem, because the test only considers differences in the data points. The Seasonal Kendall Test also can be used with missing and censored data.

Differences in flow also can produce trends in water quality. To adjust the concentrations to compensate for flow, a technique known as Locally Weighted Scatterplot Smoothing (LOWESS), described by Hirsch and others (1991), was used. This technique flow-adjusts the concentrations by using the residual, the result of the actual observation minus the expected observation. The residuals were tested for trends using the Seasonal Kendall Test. Detailed descriptions of the procedures for Seasonal Kendall Test and LOWESS can be found in Trends in Nitrogen, Phosphorus, and Suspended Sediment in the Susquehanna River Basin, 1974-93 (Edwards, 1995).

RESULTS

Water Quality

During fiscal year 1999, water quality in most interstate streams continued to meet designated use classes and water quality standards (Table 9, Appendix D). The parameter that most frequently exceeded water quality standards was total iron (Table 10, Figure 5). Only 23 out of 2,228 observations exceeded water quality standards.

Biological Communities and Physical Habitat

RBP III biological data for New York-Pennsylvania, Pennsylvania-Maryland, and river sites are summarized in Tables 11 through 13, respectively. A high rapid bioassessment protocol score indicates a low degree of impairment and a healthy macroinvertebrate population. RBP III results for each site can be found in the "Bioassessment of Interstate Streams" section, beginning on page 44.

RBP III physical habitat data for New York-Pennsylvania, Pennsylvania-Maryland, and river sites are presented in Tables 14 through 16, respectively. A high score indicates a high-quality physical habitat. RBP III physical habitat and biological data are summarized in Figures 6 through 8.

New York-Pennsylvania streams

New York-Pennsylvania sampling stations consisted of 14 sites located near or on the New York-Pennsylvania border. The biological communities of seven (50 percent) of these streams were nonimpaired. Five streams were slightly impaired (35.7 percent), and two streams were moderately impaired (14.3 percent). Two of the New York-Pennsylvania sites had excellent habitat (14.3 percent). Six sites (42.9 percent) had

Table 9. Stream Classifications

Stream	Pa. Classification *	N.Y. Classification *
Apalachin Creek	CWF	D
Bentley Creek	WWF	D
Cascade Creek	CWF	C (T)
Cayuta Creek	WWF	B
Chemung River	WWF	C
Choconut Creek	WWF	C
Cowanesque River	WWF	C
Holden Creek	WWF	
Little Snake Creek	CWF	C
North Fork Cowanesque River	CWF	
Seeley Creek	CWF	C
Snake Creek	CWF	C
South Creek	TSF	C
Susquehanna River @ Windsor		B
Susquehanna River @ Kirkwood	WWF	
Susquehanna River @ Waverly	WWF	B
Tioga River	WWF	C
Trowbridge Creek	CWF	C
Troups Creek	CWF	D
Wappasening Creek	CWF	C
	Pa. Classification	**Md. Classification ***
Big Branch Deer Creek	CWF	III-P
Conowingo Creek	CWF	I-P
Deer Creek	CWF	III-P
Ebaughs Creek	CWF	III-P
Falling Branch Deer Creek	CWF	IV-P
Long Arm Creek	WWF	I-P
Octoraro Creek	TSF-MF	IV-P
Scott Creek	TSF	
South Branch Conewago Creek	WWF	
Susquehanna River @ Marietta	WWF	
Susquehanna River @ Conowingo		I

* See Appendix D for stream classification descriptions

Table 10. Water Quality Standard Summary

Parameter	Number of Observations	Number Exceeding Standards	Standard
Alkalinity	80	2	Pa. aquatic life
Dissolved Iron	78	2	Pa. aquatic life
Total Iron	78	13	N.Y. health (water source)
	78	1	Pa. aquatic life
Total Manganese	78	1	N.Y. health (water source)
	78	1	Pa. water supply
pH	80	1	N.Y. aquatic life
	80	1	Md. aquatic life
Dissolved Oxygen	77	1	Pa. aquatic life

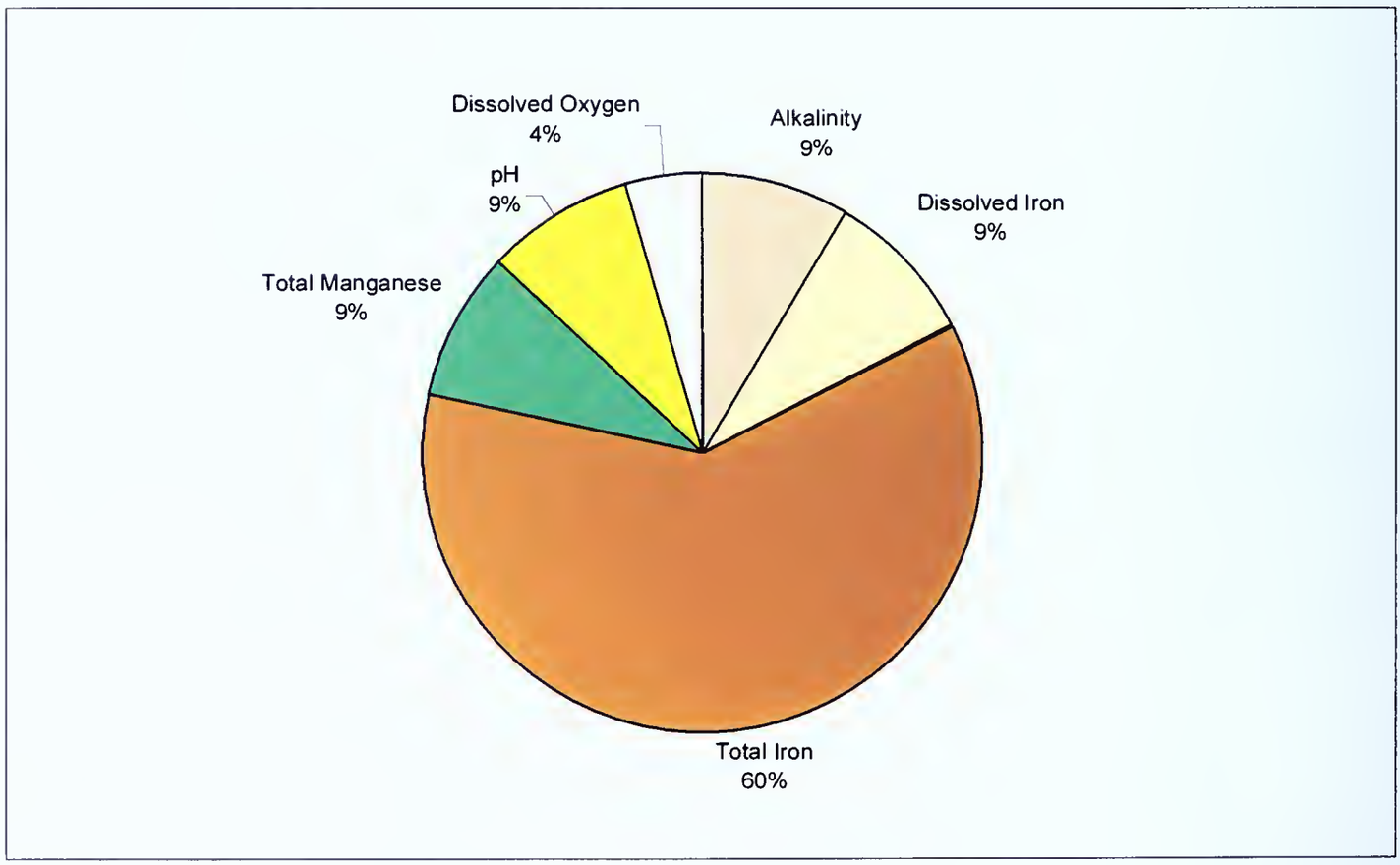


Figure 5. Parameters Exceeding Water Quality Standards

Table 11. Summary of New York-Pennsylvania Border RBP III Biological Data

	SNAK 2.3	CASC 1.6	SEEL 10.3	APAL 6.9	CHOC 9.1	TROW 1.8
Raw Summary						
Number of Individuals	109	138	132	198	142	150
% Shredders	0.9	0.0	0.0	0.5	1.4	0.0
% Collector-Gatherers	40.4	15.2	72.0	13.6	19.7	50.7
% Filterer-Collectors	28.4	44.2	12.9	36.4	41.5	31.3
% Scrapers	18.3	12.3	5.3	38.9	25.4	10.0
% Predators	11.9	28.3	9.8	10.6	12.0	8.0
Number of EPT Taxa	15	12	6	13	11	13
Number of EPT Individuals	52	72	27	89	69	75
Number of Common Species	25	12	9	15	15	14
Metric Scores						
Taxonomic Richness	25	19	12	23	18	19
Shannon Diversity Index	3.90	3.55	1.87	3.75	3.52	3.07
Modified Hilsenhoff Biotic Index	4.01	3.01	5.98	4.31	4.00	4.31
EPT Index	15	12	6	13	11	13
Ratio Scrapers/Filterers	0.65	0.28	0.41	1.07	0.61	0.32
Ratio EPT/Chironomids	2.00	4.50	0.31	4.94	2.88	1.34
Community Loss Index	0.00	0.68	1.33	0.43	0.56	0.58
Percent Dominant Taxa	23.85	21.74	66.67	20.20	19.01	37.33
Percent of Reference						
Taxonomic Richness	100	76.0	48.0	92.0	72.0	76.0
Shannon Diversity Index	100	91.0	47.9	96.4	90.3	78.9
Hilsenhoff Index	100	133.0	67.1	93.1	100.2	92.9
EPT Index	100	80.0	40.0	86.7	73.3	86.7
Ratio Scrapers/Filterers	100	43.2	63.8	165.8	94.6	49.5
Ratio EPT/Chironomids	100	225.0	15.3	247.2	143.8	67.0
Community Loss Index	0	0.7	1.3	0.4	0.6	0.6
Percent Dominant Taxa	23.85	21.7	66.7	20.2	19.0	37.3
Biological Condition Scores						
Taxonomic Richness	6	4	2	6	4	4
Shannon Diversity Index	6	6	2	6	6	6
Hilsenhoff Index	6	6	2	6	6	6
EPT Index	6	4	0	4	2	6
Ratio Scrapers/Filterers	6	4	6	6	6	6
Ratio EPT/Chironomids	6	6	0	6	6	6
Community Loss Index	6	4	4	6	4	4
Percent Dominant Taxa	4	4	0	4	6	2
Total Biological Score						
Total Biological Score	46	38	16	44	40	34
Biological % of Reference	100	83	35	96	87	74

Table 11. Summary of New York-Pennsylvania Border RBP III Biological Data—Continued

	SOUT 6.9	TRUP 4.5	BNTY 0.9	WAPP 2.6	CAYT 1.7	LSNK 7.6
Raw Summary						
Number of Individuals	145	135	113	125	96	148
% Shredders	0.7	0.0	0.9	0.8	2.1	0.7
% Collector-Gatherers	17.9	47.4	38.1	30.4	20.8	20.3
% Filterer-Collectors	26.2	36.3	29.2	42.4	33.3	41.9
% Scrapers	46.2	1.5	10.6	19.2	40.6	8.8
% Predators	9.0	14.8	21.2	7.2	3.1	28.4
Number of EPT Taxa	9	9	8	13	13	11
Number of EPT Individuals	43	66	50	78	69	72
Number of Common Species	16	11	10	17	14	14
Metric Scores						
Taxonomic Richness	20	17	13	24	19	19
Shannon Diversity Index	3.41	2.85	2.76	3.78	3.64	3.62
Modified Hilsenhoff Biotic Index	4.57	5.28	4.82	4.01	4.18	4.41
EPT Index	9	9	8	13	13	11
Ratio Scrapers/Filterers	1.76	0.04	0.36	0.45	1.22	0.21
Ratio EPT/Chironomids	1.95	1.18	1.25	3.90	7.67	2.57
Community Loss Index	0.45	0.82	1.15	0.33	0.58	0.58
Percent Dominant Taxa	26.90	41.48	35.40	19.20	18.75	18.92
Percent of Reference						
Taxonomic Richness	80.0	68.0	52.0	96.0	76.0	76.0
Shannon Diversity Index	87.4	73.1	70.8	97.1	93.4	93.0
Hilsenhoff Index	87.7	75.9	83.1	100.0	96.0	90.9
EPT Index	60.0	60.0	53.3	86.7	86.7	73.3
Ratio Scrapers/Filterers	273.3	6.3	56.4	70.2	188.9	32.5
Ratio EPT/Chironomids	97.7	58.9	62.5	195.0	383.3	128.6
Community Loss Index	0.5	0.8	1.2	0.3	0.6	0.6
Percent Dominant Taxa	26.9	41.5	35.4	19.2	18.8	18.9
Biological Condition Scores						
Taxonomic Richness	6	4	2	6	4	4
Shannon Diversity Index	6	4	4	6	6	6
Hilsenhoff Index	6	4	4	6	6	6
EPT Index	0	0	0	4	4	2
Ratio Scrapers/Filterers	6	0	6	6	6	2
Ratio EPT/Chironomids	6	4	4	6	6	6
Community Loss Index	6	4	4	6	4	4
Percent Dominant Taxa	4	0	2	6	6	6
Total Biological Score						
Total Biological Score	40	20	26	46	42	36
Biological % of Reference	87	43	57	100	91	78

Table 11. Summary of New York-Pennsylvania Border RBP III Biological Data—Continued

	HLDN 3.5	NFCR 7.6
Raw Summary		
Number of Individuals	103	206
% Shredders	0.0	2.9
% Collector-Gatherers	25.2	52.4
% Filterer-Collectors	43.7	19.4
% Scrapers	9.7	14.1
% Predators	21.4	11.2
Number of EPT Taxa	14	14
Number of EPT Individuals	68	76
Number of Common Species	14	16
Metric Scores		
Taxonomic Richness	22	26
Shannon Diversity Index	3.76	3.29
Modified Hilsenhoff Biotic Index	4.32	5.06
EPT Index	14	14
Ratio Scrapers/Filterers	0.22	0.73
Ratio EPT/Chironomids	4.86	0.87
Community Loss Index	0.50	0.35
Percent Dominant Taxa	21.36	42.23
Percent of Reference		
Taxonomic Richness	88.0	104.0
Shannon Diversity Index	96.5	84.5
Hilsenhoff Index	92.8	79.3
EPT Index	93.3	93.3
Ratio Scrapers/Filterers	34.4	112.4
Ratio EPT/Chironomids	242.9	43.7
Community Loss Index	0.5	0.3
Percent Dominant Taxa	21.4	42.2
Biological Condition Scores		
Taxonomic Richness	6	6
Shannon Diversity Index	6	6
Hilsenhoff Index	6	4
EPT Index	6	6
Ratio Scrapers/Filterers	2	6
Ratio EPT/Chironomids	6	2
Community Loss Index	6	6
Percent Dominant Taxa	4	0
Total Biological Score		
Total Biological Score	42	36
Biological % of Reference	91	78

Table 12. Summary of Pennsylvania-Maryland Border RBP III Biological Data

	BBDC 4.1	SBCC 20.4	SCTT 3.0	EBAU 1.5	FBDC 4.1
Raw Data Summary					
Number of Individuals	135	124	100	129	131
% Shredders	14.1	4.8	0.0	3.9	19.8
% Collector-Gatherers	15.6	18.5	85.0	24.0	26.0
% Filterer-Collectors	30.4	37.9	0.0	41.9	17.6
% Scrapers	28.1	16.9	15.0	26.4	16.8
% Predators	11.9	21.8	0.0	3.9	19.8
Number of EPT Taxa	15	9	1	8	10
Number of EPT Individuals	72	69	1	65	69
Number of Common Species	21	11	2	10	13
Metric Scores					
Taxonomic Richness	21	17	4	18	21
Shannon Diversity Index	3.76	3.69	1.48	3.30	3.75
Modified Hilsenhoff Biotic Index	3.33	3.44	7.44	4.56	3.81
EPT Index	15	9	1	8	10
Ratio Scrapers/Filterers	0.93	0.45	0.00	0.63	0.96
Ratio EPT/Chironomids	6.55	3.83	0.02	3.10	2.65
Community Loss Index	0.00	0.59	4.75	0.61	0.38
Percent Dominant Taxa	25.19	16.13	54.00	26.36	19.85
Percent of Reference					
Taxonomic Richness	100	81.0	19.0	85.7	100.0
Shannon Diversity Index	100	98.3	39.3	87.7	99.8
Hilsenhoff Index	100	96.8	44.7	73.0	87.3
EPT Index	100	60.0	6.7	53.3	66.7
Ratio Scrapers/Filterers	100	48.2	0.0	67.9	103.2
Ratio EPT/Chironomids	100	58.6	0.3	47.3	40.5
Community Loss Index	0	0.6	4.8	0.6	0.4
Percent Dominant Taxa	25.2	16.1	54.0	26.4	19.8
Biological Condition Scores					
Taxonomic Richness	6	6	0	6	6
Shannon Diversity Index	6	6	2	6	6
Hilsenhoff Index	6	6	0	4	6
EPT Index	6	0	0	0	0
Ratio Scrapers/Filterers	6	4	0	6	6
Ratio EPT/Chironomids	6	4	0	2	2
Community Loss Index	6	4	0	4	6
Percent Dominant Taxa	4	6	0	4	6
Total Biological Score					
Total Biological Score	46	36	2	32	38
Biological % of Reference	100	78	4	70	83

Table 12. Summary of Pennsylvania-Maryland Border RBP III Biological Data—Continued

	CNWG 4.4	LNGA 2.5	DEER 44.5	OCTO 6.6
Raw Data Summary				
Number of Individuals	157	114	144	145
% Shredders	1.9	7.9	0.7	6.2
% Collector-Gatherers	18.5	27.2	14.6	12.4
% Filterer-Collectors	36.3	27.2	29.9	25.5
% Scrapers	33.8	33.3	44.4	54.5
% Predators	9.6	4.4	10.4	1.4
Number of EPT Taxa	9	7	10	10
Number of EPT Individuals	96	41	61	80
Number of Common Species	9	9	13	6
Metric Scores				
Taxonomic Richness	18	17	22	17
Shannon Diversity Index	3.51	3.21	3.74	3.28
Modified Hilsenhoff Biotic Index	4.27	4.83	4.06	4.25
EPT Index	9	7	10	10
Ratio Scrapers/Filterers	0.93	1.23	1.49	2.14
Ratio EPT/Chironomids	6.00	1.71	6.10	80.00
Community Loss Index	0.67	0.71	0.3	0.88
Percent Dominant Taxa	17.20	26.32	20.14	31.03
Percent of Reference				
Taxonomic Richness	85.7	81.0	104.8	81.0
Shannon Diversity Index	93.5	85.4	99.5	87.2
Hilsenhoff Index	77.9	68.8	81.9	78.3
EPT Index	60.0	46.7	66.7	66.7
Ratio Scrapers/Filterers	100.3	132.3	160.6	230.4
Ratio EPT/Chironomids	91.7	26.1	93.2	1222.2
Community Loss Index	0.7	0.7	0.4	0.9
Percent Dominant Taxa	17.2	26.3	20.1	31.0
Biological Condition Scores				
Taxonomic Richness	6	6	6	6
Shannon Diversity Index	6	6	6	6
Hilsenhoff Index	4	2	4	4
EPT Index	0	0	0	0
Ratio Scrapers/Filterers	6	6	6	6
Ratio EPT/Chironomids	6	2	6	6
Community Loss Index	4	4	6	4
Percent Dominant Taxa	6	4	4	2
Total Biological Score				
Total Biological Score	38	30	38	34
Biological % of Reference	83	65	83	74

Table 13. Summary of River RBP III Biological Data

	SUSQ 289.1	SUSQ 365	SUSQ 340	SUSQ 44.5
Raw Summary				
Number of Individuals	128	165	117	144
% Shredders	0.0	0.0	0.9	0.0
% Collector-Gatherers	9.4	10.3	28.2	28.5
% Filterer-Collectors	45.3	19.4	23.1	42.4
% Scrapers	38.3	52.1	39.3	28.5
% Predators	7.0	18.2	8.5	0.7
Number of EPT Taxa	12	11	15	10
Number of EPT Individuals	76	66	61	99
Number of Common Species	19	13	11	13
Metric Scores				
Taxonomic Richness	19	21	23	17
Shannon Diversity Index	3.69	3.27	3.91	3.48
Modified Hilsenhoff Biotic Index	4.06	4.07	4.37	4.49
EPT Index	12	11	15	10
Ratio Scrapers/Filterers	0.85	2.69	1.70	0.67
Ratio EPT/Chironomids	19.00	13.20	10.17	99.00
Community Loss Index	0.00	0.29	0.34	0.35
Percent Dominant Taxa	19.53	40.00	18.80	20.83
Percent of Reference				
Taxonomic Richness	100	110.5	121.1	89.5
Shannon Diversity Index	100	88.5	105.9	94.3
Hilsenhoff Index	100	99.9	93.0	90.4
EPT Index	100	91.7	125.0	83.3
Ratio Scrapers/Filterers	100	318.1	201.7	79.6
Ratio EPT/Chironomids	100	69.5	53.5	521.1
Community Loss Index	0	0.3	0.3	0.4
Percent Dominant Taxa	19.5	40.0	18.8	20.8
Biological Condition Scores				
Taxonomic Richness	6	6	6	6
Shannon Diversity Index	6	6	6	6
Hilsenhoff Index	6	6	6	6
EPT Index	6	6	6	4
Ratio Scrapers/Filterers	6	6	6	6
Ratio EPT/Chironomids	6	4	4	6
Community Loss Index	6	6	6	6
Percent Dominant Taxa	6	2	6	4
Total Biological Score				
Total Biological Score	48	42	46	44
Percent of Reference	100	88	96	92

Table 13. Summary of River RBP III Biological Data—Continued

	CHEM 12.0	COWN 2.2	TIOG 10.8
Raw Summary			
Number of Individuals	112	125	126
% Shredders	0	56.0	0.0
% Collector-Gatherers	21.4	26.4	10.3
% Filterer-Collectors	57.1	17.6	73.0
% Scrapers	17.0	0.0	8.7
% Predators	4.5	0.0	7.9
Number of EPT Taxa	10	3	8
Number of EPT Individuals	70	21	98
Number of Common Species	11	3	9
Metric Scores			
Taxonomic Richness	19	7	16
Shannon Diversity Index	3.57	1.84	3.31
Modified Hilsenhoff Biotic Index	4.52	7.18	4.16
EPT Index	10	3	8
Ratio Scrapers/Filterers	0.30	0.00	0.12
Ratio EPT/Chironomids	3.89	0.75	9.80
Community Loss Index	0.42	2.29	0.63
Percent Dominant Taxa	17.86	56.00	26.98
Percent of Reference			
Taxonomic Richness	100.0	36.8	84.2
Shannon Diversity Index	96.7	50.0	89.6
Hilsenhoff Index	89.9	56.5	97.7
EPT Index	83.3	25.0	66.7
Ratio Scrapers/Filterers	35.1	0.00	14.2
Ratio EPT/Chironomids	20.5	3.9	51.6
Community Loss Index	0.4	2.3	0.6
Percent Dominant Taxa	17.9	56.0	27.0
Biological Condition Scores			
Taxonomic Richness	6	0	6
Shannon Diversity Index	6	2	6
Hilsenhoff Index	6	2	6
EPT Index	4	0	0
Ratio Scrapers/Filterers	4	0	0
Ratio EPT/Chironomids	0	0	4
Community Loss Index	6	2	4
Percent Dominant Taxa	6	0	4
Total Biological Score			
Total Biological Score	38	6	30
Percent of Reference	79	13	63

Table 14. Summary of New York-Pennsylvania Sites Physical Habitat Data

	SNAK 2.3	CASC 1.6	TROW 1.8	LSNK 7.6	CHOC 9.1	APAL 6.9
Primary Parameters						
Bottom Substrate	17	13	14	15	15	10
Embeddedness	17	14	17	17	16	9
Velocity/Depth Diversity	17	7	6	7	10	5
Secondary Parameters						
Pool/Riffle Ratio	13	7	6	7	11	3
Pool Quality	11	9	3	7	7	12
Riffle/Run Quality	11	7	4	7	8	7
Channel Alteration	11	6	10	11	6	8
Tertiary Parameters						
Streambank Erosion	5	5	5	7	6	6
Streambank Stability	5	2	9	9	9	5
Streamside Vegetative Cover	7	7	4	9	9	9
Riparian Buffer Zone	4	5	2	9	2	2
Total Habitat Score						
Total Habitat Score	118	82	80	105	99	76
Habitat Percent of Reference	100	70	68	89	84	64

	WAPP 2.6	CAYT 1.7	SOUT 6.9	BNTY 0.9	TRUP 4.5	SEEL 10.3
Primary Parameters						
Bottom Substrate	14	10	16	10	15	8
Embeddedness	16	13	17	17	16	16
Velocity/Depth Diversity	14	12	7	9	10	8
Secondary Parameters						
Pool/Riffle Ratio	13	11	7	7	10	6
Pool Quality	11	7	6	6	7	6
Riffle/Run Quality	10	10	6	7	8	7
Channel Alteration	7	7	12	3	8	3
Tertiary Parameters						
Streambank Erosion	2	5	8	2	5	2
Streambank Stability	5	8	9	2	5	2
Streamside Vegetative Cover	2	5	9	2	5	2
Riparian Buffer Zone	5	2	2	5	2	5
Total Habitat Score						
Total Habitat Score	99	90	99	70	91	65
Habitat Percent of Reference	84	76	84	59	77	55

Table 14. Summary of New York-Pennsylvania Sites Physical Habitat Data – continued.

	HLDN 3.5	NFCR 7.6
Primary Parameters		
Bottom Substrate	12	16
Embeddedness	14	17
Velocity/Depth Diversity	6	9
Secondary Parameters		
Pool/Riffle Ratio	6	10
Pool Quality	5	7
Riffle/Run Quality	6	8
Channel Alteration	9	11
Tertiary Parameters		
Streambank Erosion	3	7
Streambank Stability	3	7
Streamside Vegetative Cover	6	9
Riparian Buffer Zone	5	8
Total Habitat Score		
Total Habitat Score	75	109
Habitat Percent of Reference	64	92

Table 15. Summary of Pennsylvania-Maryland Sites Physical Habitat Data

	BBDC 4.1	LNGA 2.5	SBCC 20.4	DEER 44.5	EBAU 1.5
Primary Parameters					
Bottom Substrate	17	11	14	16	15
Embeddedness	17	11	14	13	15
Velocity/Depth Diversity	10	7	10	14	7
Secondary Parameters					
Pool/Riffle Ratio	10	7	9	13	8
Pool Quality	10	6	7	11	3
Riffle/Run Quality	9	7	7	10	11
Channel Alteration	12	12	8	12	12
Tertiary Parameters					
Streambank Erosion	6	2	8	4	8
Streambank Stability	7	2	9	4	9
Streamside Vegetative Cover	7	4	8	5	5
Riparian Buffer Zone	7	2	6	2	2
Total Habitat Score					
Total Habitat Score	112	71	100	104	95
Habitat Percent of Reference	100	63	89	93	85

	FBDC 4.1	SCTT 3.0	CNWG 4.4	OCTO 6.6
Primary Parameters				
Bottom Substrate	8	14	17	16
Embeddedness	7	12	15	16
Velocity/Depth Diversity	4	5	17	12
Secondary Parameters				
Pool/Riffle Ratio	6	8	12	13
Pool Quality	3	6	12	10
Riffle/Run Quality	6	6	10	13
Channel Alteration	12	8	10	11
Tertiary Parameters				
Streambank Erosion	5	5	6	6
Streambank Stability	6	6	8	7
Streamside Vegetative Cover	4	7	7	5
Riparian Buffer Zone	2	3	5	7
Total Habitat Score				
Total Habitat Score	63	80	119	116
Habitat Percent of Reference	56	71	106	103

Table 16. Summary of River Sites Physical Habitat Data

	SUSQ 289.1	SUSQ 365	CHEM 12.0	SUSQ 340
Primary Parameters				
Bottom Substrate	16	17	14	11
Embeddedness	16	17	11	16
Velocity/Depth Diversity	16	15	16	9
Secondary Parameters				
Pool/Riffle Ratio	13	11	8	3
Pool Quality	11	13	12	11
Riffle/Run Quality	12	13	13	3
Channel Alteration	10	10	9	12
Tertiary Parameters				
Streambank Erosion	7	8	5	7
Streambank Stability	9	8	8	8
Streamside Vegetative Cover	5	7	5	5
Riparian Buffer Zone	2	5	5	5
Total Habitat Score				
Total Habitat Score	117	124	106	90
Habitat Percent of Reference	100	106	91	77

	TIOG 10.8	COWN 2.2	SUSQ 44.5
Primary Parameters			
Bottom Substrate	15	5	7
Embeddedness	14	10	13
Velocity/Depth Diversity	15	5	16
Secondary Parameters			
Pool/Riffle Ratio	11	3	10
Pool Quality	13	8	9
Riffle/Run Quality	13	3	9
Channel Alteration	12	11	12
Tertiary Parameters			
Streambank Erosion	7	6	8
Streambank Stability	7	8	9
Streamside Vegetative Cover	8	5	5
Riparian Buffer Zone	7	2	3
Total Habitat Score			
Total Habitat Score	122	66	101
Habitat Percent of Reference	104	56	86

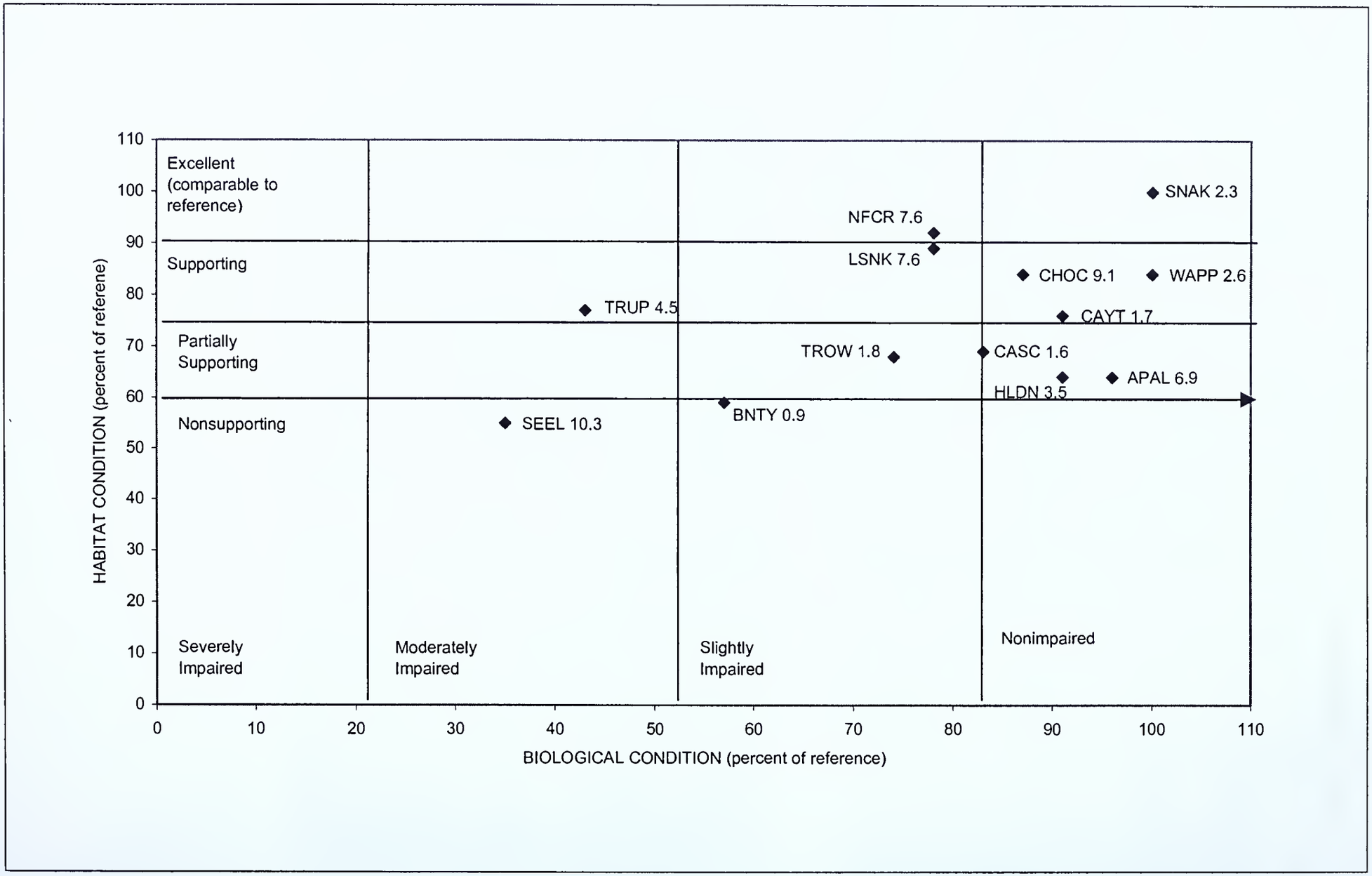


Figure 6. Summary of New York-Pennsylvania Border Streams Habitat and Biological Condition Scores

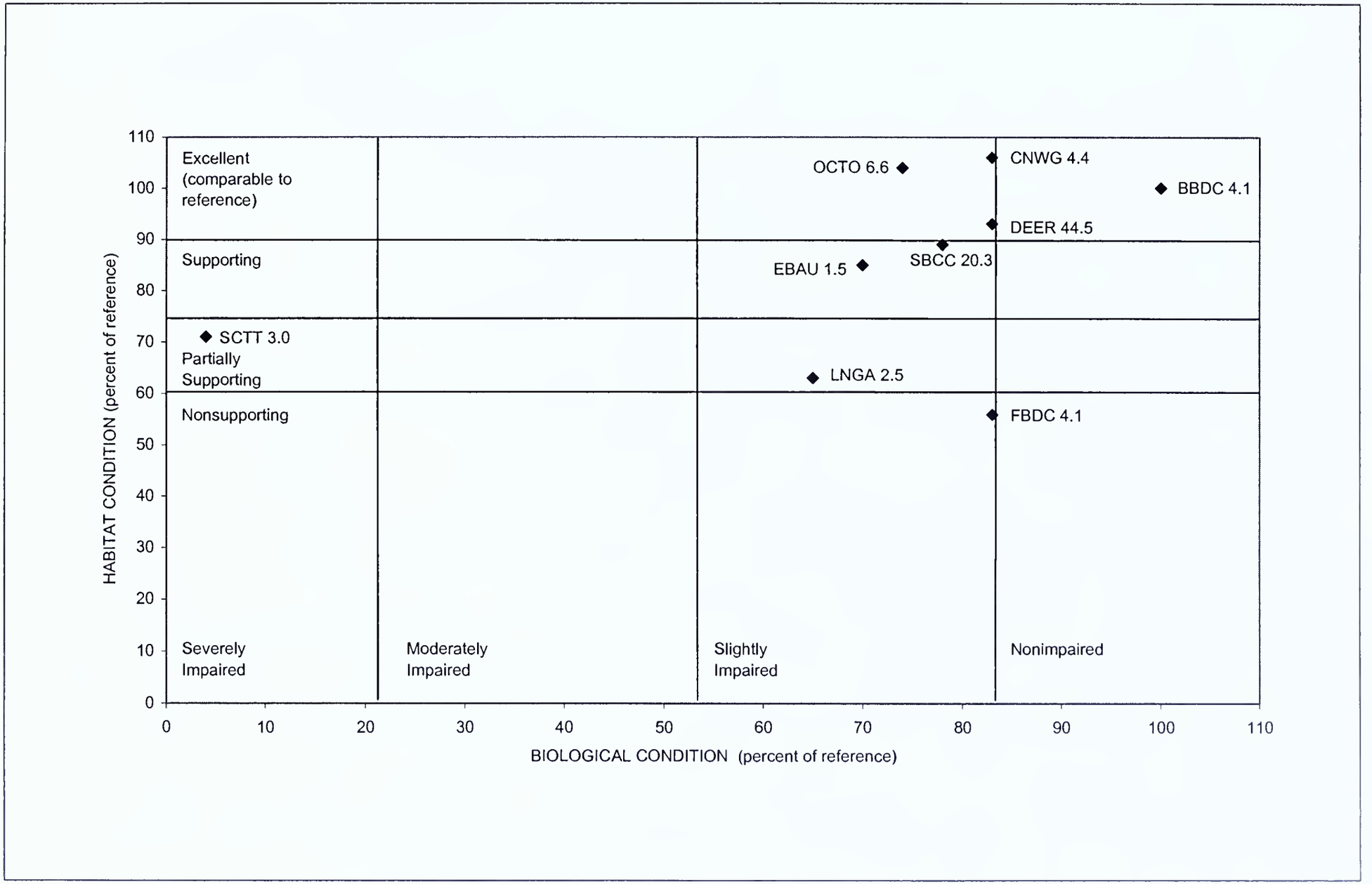


Figure 7. Summary of Pennsylvania-Maryland Border Streams Habitat and Biological Condition Scores

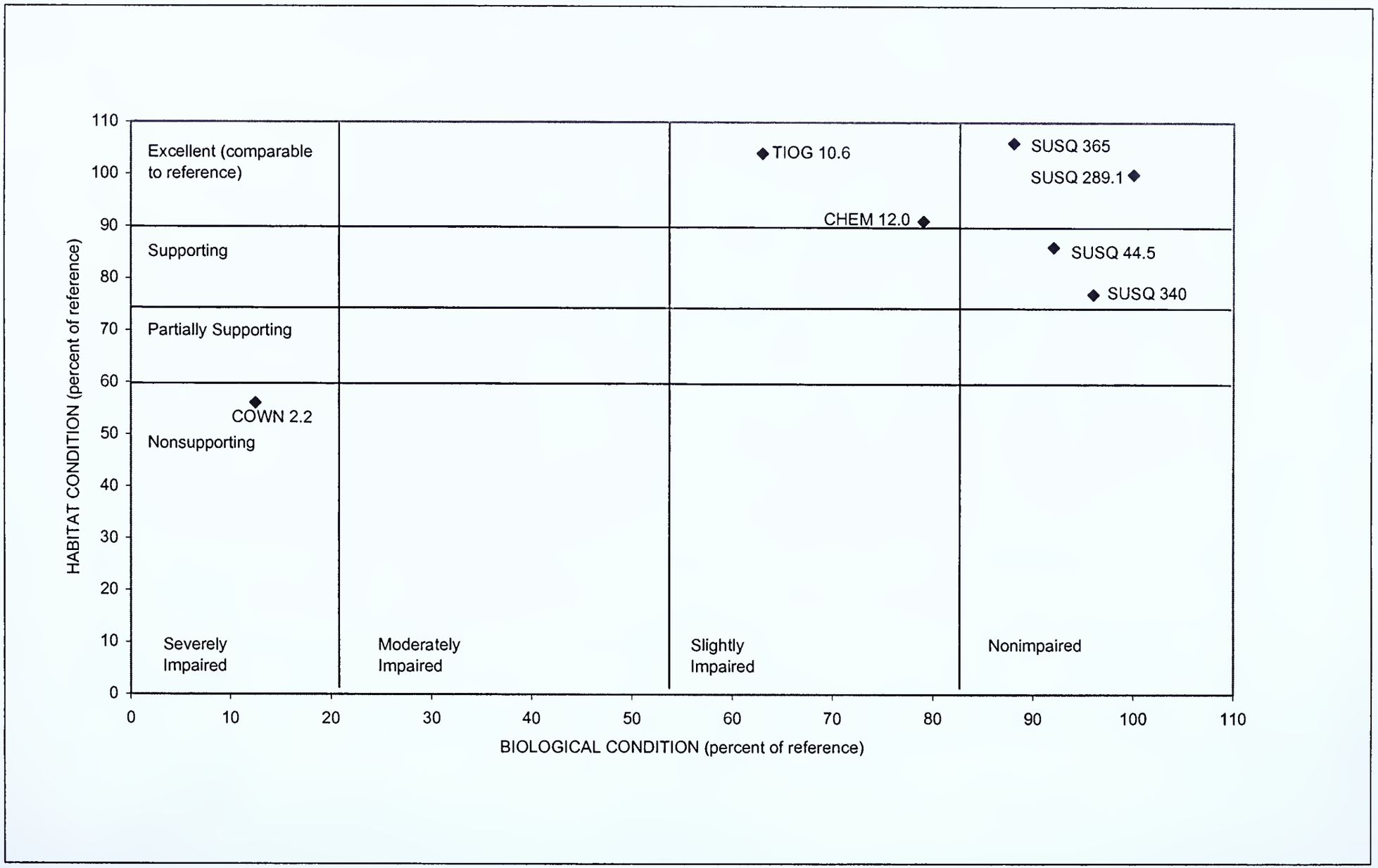


Figure 8. Summary of River Sites Habitat and Biological Condition Scores

supporting habitat, four sites (28.6 percent) had partially supporting habitat, and two sites (14.3 percent) had nonsupporting habitat.

Pennsylvania-Maryland streams

The Pennsylvania-Maryland interstate streams included nine stations located on or near the Pennsylvania-Maryland border. One stream (11.1 percent) was designated nonimpaired, using RBP III protocol designations. Of the remaining eight sites, seven sites (77.7 percent) were slightly impaired, while one site (11.1 percent) was designated severely impaired. Four (44.4 percent) of the Pennsyl-vania-Maryland border sites had excellent habitat. Two sites (22.2 percent) had supporting habitat, two sites (22.2 percent) had partially supporting habitat, and one site (11.1 percent) had nonsupporting habitat.

River sites

River sites consisted of eight stations located on the Susquehanna River, Chemung River, Cowanesque River, and Tioga River. One station (SUSQ 10.0) was not sampled for macroinvertebrates due to a lack of riffle habitat at the site. The biological communities of four sites (57.1 percent) were nonimpaired, two sites (28.6 percent) were slightly impaired, and one site (14.3 percent) was severely impaired. Three of the sites (42.9 percent) had excellent habitats Of the remaining four sites, three sites (42.9 percent) had supporting habitat, and one site (14.3 percent) had nonsupporting habitat.

Trends Analysis

A summary of trend statistics is presented in Table 17. The statistical trends were simplified into trend categories: a highly significant ($p<0.05$) trend that was increasing (INC) or decreasing (DEC); a significant ($p<0.10$) trend that was increasing (inc) or decreasing (dec); or no trend (0). The trend categories are presented for both the concentration and the flow-adjusted concentrations. In Tables 18 and 19, weighted values were assigned for each station, and an average weighted value was calculated to indicate the strength of an overall trend for each variable. Each category was given a value: -2 for DEC, -1 for dec, 0 for 0, +1 for inc, and +2 for INC. An average value was calculated for each parameter. An analysis of "strong decreasing trend" required an average weighted value of less than –1.50. An analysis of "decreasing trend" required an average value between –1.00 and –1.50. An analysis of no trend was indicated by a value of –1.00 to +1.00.

Detailed results of the Seasonal Kendall Test are presented in Appendix E, Tables E1-E8. The statistics include the probability (P), slope estimate (b), Kendall's Tau median, and percent slope. The median was calculated from the median of the entire quarterly time series. The percent slope was expressed in percent of the median concentration per year and was calculated by dividing the slope (b) by the median and multiplying by 100. The percent slope identifies those stations for which trend slope (b) is large with respect to the median value.

Total suspended solids

Trend analysis results for total suspended solids are presented in Appendix E, Table E1. Concentration values at the stations showed two decreasing trends at Cayuta Creek and Cowanesque River and one strongly increasing trend at Ebaughs Creek (Table 17). Flow-adjusted concentration analysis indicated one strongly decreasing trend at Cayuta Creek, one decreasing trend at Susquehanna River site 289.1, and one strongly increasing trend at Ebaughs Creek (Table 17). There was no overall trend, indicated by a weighted value of 0 for unadjusted concentrations and –0.07 for flow-adjusted concentrations (Tables 18 and 19, respectively).

Total ammonia

Total ammonia trend analysis results are presented in Appendix E, Table E2. Concentration values showed nine strongly decreasing values at Cayuta Creek, Chemung River, Deer Creek, Ebaughs Creek, Octoraro Creek, Tioga River, and Susquehanna River sites 289.1, 340, and 365. Susquehanna River sites 10 and 44.5 had decreasing trends (Table 17). Flow-

Table 17. Trend Summary of Selected Parameters for Group 1 Streams, 1986-99

Site	Total Solids		Total Ammonia		Total Nitrogen		Total Phosphorus		Total Chloride	
	CONC	FAC	CONC	FAC	CONC	FAC	CONC	FAC	CONC	FAC
Cayuta Creek	dec	DEC	DEC	dec	0	DEC	DEC	DEC	0	0
Chemung River	0	0	DEC	DEC	0	0	DEC	DEC	0	INC
Conowingo Creek	0	0	0	0	INC	INC	DEC	DEC	INC	INC
Cowanesque River	dec	0	0	0	0	0	0	0	0	0
Deer Creek	0	0	DEC	0	inc	inc	DEC	DEC	INC	INC
Ebaughs Creek	INC	INC	DEC	0	0	0	DEC	DEC	INC	INC
Octoraro Creek	0	0	DEC	0	INC	inc	DEC	dec	INC	INC
Scott Creek	0	0	0	0	INC	inc	DEC	DEC	0	0
Susquehanna River 10.0	0	0	dec	0	0	dec	DEC	dec	0	0
Susquehanna River 44.5	0	0	dec	DEC	0	0	DEC	DEC	0	0
Susquehanna River 289.1	0	dec	DEC	dec	DEC	DEC	DEC	DEC	INC	INC
Susquehanna River 340	0	0	DEC	DEC	DEC	DEC	DEC	DEC	0	0
Susquehanna River 365	0	0	DEC	DEC	DEC	0	DEC	DEC	0	0
Tioga River	0	0	DEC	DEC	0	0	dec	0	0	DEC
Troups Creek	0	0	0	0	0	0	0	0	0	0

Site	Total Sulfate		Total Iron		Total Aluminum		Total Manganese		WQI	
	CONC	FAC	CONC	FAC	CONC	FAC	CONC	FAC	CONC	FAC
Cayuta Creek	DEC	DEC	DEC	0	0	0	DEC	DEC	dec	0
Chemung River	DEC	DEC	DEC	DEC	0	0	0	0	0	0
Conowingo Creek	0	0	DEC	DEC	DEC	DEC	DEC	DEC	0	0
Cowanesque River	DEC	DEC	0	0	0	0	0	0	INC	inc
Deer Creek	inc	0	DEC	DEC	0	0	DEC	0	DEC	0
Ebaughs Creek	0	0	DEC	DEC	0	0	DEC	DEC	INC	inc
Octoraro Creek	0	0	DEC	0	0	0	dec	DEC	0	0
Scott Creek	DEC	DEC	DEC	DEC	0	0	0	0	DEC	DEC
Susquehanna River 10.0	dec	0	DEC	dec	0	dec	0	dec	0	0
Susquehanna River 44.5	0	DEC	DEC	DEC	dec	0	DEC	0	dec	DEC
Susquehanna River 289.1	0	0	DEC	DEC	dec	DEC	DEC	DEC	inc	inc
Susquehanna River 340	0	0	DEC	DEC	0	0	dec	0	0	0
Susquehanna River 365	0	0	DEC	DEC	0	DEC	dec	DEC	0	0
Tioga River	DEC	DEC	0	0	0	INC	0	DEC	0	0
Troups Creek	DEC	DEC	0	0	0	0	0	0	0	0

INC Strong, Significant Increasing Trend; Probability < 5 %
inc Significant Increasing Trend; 5 % < Probability < 10 %
O No Significant Trend; Probability > 10%
dec Significant Decreasing Trend; 5 % < Probability < 10 %
DEC Strong, Significant Decreasing Trend; Probability < 5 %
CONC Concentrations
FAC Flow-Adjusted Concentrations

Table 18. Trend Category Counts and Weighted Values of Unadjusted Concentrations for Group 1 Streams

Concentration	Trend Category Count					
	DEC	dec	O	inc	INC	Total
Total Solids	0	2	12	0	1	15
Total Ammonia	9	2	4	0	0	15
Total Nitrogen	3	0	8	1	3	15
Total Phosphorus	12	1	2	0	0	15
Total Chlorides	0	0	10	0	5	15
Total Sulfate	6	1	7	1	0	15
Total Iron	12	0	3	0	0	15
Total Aluminum	1	2	12	0	0	15
Total Manganese	6	3	6	0	0	15
Water Quality Index	2	2	8	1	2	15

Concentration	Weighted Values						
	DEC	dec	O	inc	INC	Sum	Average Value*
Total Solids	0	-2	0	0	2	0	0
Total Ammonia	-18	-2	0	0	0	-20	-1.33
Total Nitrogen	-6	0	0	1	6	1	0.07
Total Phosphorus	-24	-2	0	0	0	-26	-1.73
Total Chlorides	0	0	0	0	10	10	0.67
Total Sulfate	-12	-1	0	1	0	-12	-0.80
Total Iron	-24	0	0	0	0	-24	-1.60
Total Aluminum	-2	-2	0	0	0	-4	-0.27
Total Manganese	-12	-3	0	0	0	-15	-1.00
Water Quality Index	-4	-2	0	1	4	-1	-0.07

DEC = -2 each
dec = -1 each
0 = 0 each
inc = 1 each
INC =2 each

*Average Value	
< - 1.50	Strong Decreasing Trend
-1.5 to -1.00	Decreasing Trend
-1.00 to 1.00	No Trend
1.00 to 1.50	Increasing Trend
>1.50	Strong Increasing Trend

Table 19. Trend Category Counts and Weighted Values of Flow-Adjusted Concentrations for Group 1 Streams

Concentration	Trend Category Count					
	DEC	dec	O	inc	INC	Total
Total Solids	1	1	12	0	1	15
Total Ammonia	5	2	8	0	0	15
Total Nitrogen	3	1	7	3	1	15
Total Phosphorus	10	2	3	0	0	15
Total Chlorides	1	0	8	0	6	15
Total Sulfate	7	0	8	0	0	15
Total Iron	9	1	5	0	0	15
Total Aluminum	3	1	10	0	1	15
Total Manganese	7	1	7	0	0	15
Water Quality Index	2	0	10	3	0	15

Concentration	*Weighted Values*						
	DEC	dec	O	inc	INC	Sum	*Average Value**
Total Solids	-2	-1	0	0	2	-1	-0.07
Total Ammonia	-10	-2	0	0	0	-14	-0.93
Total Nitrogen	-6	-1	0	3	2	-2	-0.13
Total Phosphorus	-20	-2	0	0	0	-22	-1.47
Total Chlorides	-2	0	0	0	12	10	0.67
Total Sulfate	-14	0	0	0	0	-14	-0.93
Total Iron	-18	-1	0	0	0	-19	-1.27
Total Aluminum	-6	-1	0	0	2	-5	-0.33
Total Manganese	-14	-1	0	0	0	-15	-1.00
Water Quality Index	-4	0	0	3	0	-1	-0.07

DEC = -2 each
dec = -1 each
0 = 0 each
inc = 1 each
INC =2 each

*Average Value	
< - 1.50	Strong Decreasing Trend
-1.5 to -1.00	Decreasing Trend
-1.00 to 1.00	No Trend
1.00 to 1.50	Increasing Trend
>1.50	Strong Increasing Trend

adjusted concentrations indicated five strongly decreasing values at Chemung River, Tioga River, and Susquehanna River sites 44.5, 340, and 365 and two decreasing trends at Cayuta Creek and Susquehanna River site 289.1 (Table 17). There was an overall decreasing trend in concentration with a weighted value of –1.33 (Table 18), but a weighted value of –0.93 indicated that there was no overall trend in flow-adjusted concentrations (Table 19).

Total nitrogen

The results of trend analysis for total nitrogen are presented in Appendix E, Table E3. Concentration values at the Group 1 stations showed three strongly decreasing trends at Susquehanna River sites 289.1, 340, and 365, one increasing site at Deer Creek, and three strongly increasing sites at Conowingo Creek, Octoraro Creek, and Scott Creek (Table 17). Note that increasing trends for total nitrogen were found only in Pennsylvania-Maryland border sites, which are heavily influenced by agriculture. Flow-adjusted concentrations indicated three strongly decreasing trends at Cayuta Creek and Susquehanna River sites 289.1 and 340. One decreasing trend was found at Susquehanna River site 10. Three increasing trends occurred at Deer Creek, Octoraro Creek, and Scott Creek, while one strongly increasing trend was found at Conowingo Creek (Table 17). Overall, there was no trend in either concentration or flow-adjusted concentrations, with average weighted values of 0.07 and –0.13, respectively (Tables 18 and 19).

Total phosphorus

Trend analysis results for total phosphorus are presented in Appendix E, Table E4. Concentration values showed 12 strongly decreasing trends at all Susquehanna River sites, Cayuta Creek, Chemung River, Conowingo Creek, Deer Creek, Ebaughs Creek, Octoraro Creek, and Scott Creek, and one decreasing trend at Tioga River (Table 17). Flow-adjusted concentrations showed 10 strongly decreasing trends at Susquehanna River sites 44.5, 289.1, 340, 365, Cayuta Creek, Chemung River, Conowingo Creek, Deer Creek, Ebaughs Creek, and Scott Creek. Decreasing trends were found at Octoraro Creek and Susquehanna River site 10 (Table 17). Overall, there was a strong decreasing trend in unadjusted phosphorus concentrations (average value = -1.73) and a decreasing trend in flow-adjusted concentration (average value = -1.47). This decreasing overall trend may have been due to a decrease of phosphates in detergents, to the application of agricultural Best Management Practices, and to the upgrade of wastewater treatment plants.

Total chloride

The results of trend analysis for total chloride are presented in Appendix E, Table E5. Concentration values showed five increasing trends in Conowingo Creek, Deer Creek, Ebaughs Creek, Octoraro Creek, and Susquehanna River site 289.1 (Table 17). Flow-adjusted concentrations indicated one strongly decreasing trend at Tioga River and six strongly increasing trends at Chemung River, Conowingo Creek, Deer Creek, Ebaughs Creek, Octoraro Creek, and Susquehanna River site 289.1 (Table 17). Overall, there was no trend in either concentration or flow-adjusted concentrations, with average weighted values of 0.67 for both analyses (Tables 18 and 19).

Total sulfate

Trend analysis results for total sulfate are presented in Appendix E, Table E6. Concentration values at the stations showed six strongly decreasing trends at Cayuta Creek, Chemung River, Cowanesque River, Scott Creek, Tioga River, and Troups Creek, one decreasing trend at Susquehanna River site 10, and one increasing site at Deer Creek (Table 17). Seven strongly decreasing trends were found at Cayuta Creek, Chemung River, Cowanesque River, Scott Creek, Susquehanna River 44.5, Tioga River, and Troups Creek, indicated by flow-adjusted concentrations (Table 17). There was no overall trend in concentrations or flow-adjusted concentrations, with weighted values of –0.80 and –0.93, respectively (Tables 18 and 19).

Total iron

Total iron trend analysis results are found in Appendix E, Table E7. Group 1 concentration values showed 12 strongly decreasing trends at all Susquehanna River sites, Cayuta Creek, Chemung River, Conowingo Creek, Deer Creek, Ebaughs Creek, Octoraro Creek, and Scott Creek (Table 17). Flow-adjusted concentrations indicated similar results, with nine strongly decreasing trends at Chemung River, Conowingo Creek, Deer Creek, Ebaughs Creek, Scott Creek, and Susquehanna River sites 44.5, 289.1, 340, and 365 and one decreasing trend at Susquehanna River site 10 (Table 17). Overall, there was a strongly decreasing trend in unadjusted concentrations for iron and an overall decreasing trend for flow-adjusted concentrations, indicated by values of –1.60 and –1.27, respectively (Tables 18 and 19).

Total aluminum

The results of trend analysis for total aluminum are presented in Appendix E, Table E8. Concentration values at the Group 1 stations showed two decreasing trends at Susquehanna River sites 44.5 and 289.1 and one strongly decreasing trend at Conowingo Creek (Table 17). Flow adjusted concentration values showed one decreasing trend at Susquehanna River site 10, three strongly decreasing trends at Conowingo Creek and Susquehanna River sites 289.1 and 365, and one strongly increasing trend at Tioga River (Table 17). There was no overall trend, indicated by a weighted value of –0.27 for the concentrations and –0.33 for flow-adjusted concentrations (Tables 18 and 19).

Total manganese

Trend analysis results for total manganese are presented in Appendix E, Table E9. Concentration values showed six strongly decreasing trends at Cayuta Creek, Conowingo Creek, Deer Creek, Ebaughs Creek, Susquehanna River site 44.5 and 289.1, and three decreasing trends at Octoraro Creek, and Susquehanna River 340 and 365 (Table 17). Flow-adjusted concentrations showed seven strongly decreasing tends at Cayuta Creek, Conowingo Creek, Ebaughs Creek, Octoraro Creek, Susquehanna River sites 289.1 and 365, and Tioga River. One decreasing trend was found at Susquehanna River site 10 (Table 17). Overall, there was a decreasing trend in both manganese concentrations and flow adjusted concentrations with a value of –1.00 for both analyses (Tables 18 and 19).

Water Quality Index

Trend analysis results for the water quality index are presented in Appendix E, Table E10. Concentration values at the stations showed two strongly decreasing trends at Deer Creek and Scott Creek, two decreasing trends at Cayuta Creek and Susquehanna River site 44.5, one increasing site at Susquehanna River site 289.1, and two strongly increasing sites at Cowanesque River and Ebaughs Creek (Table 17). Flow-adjusted concentrations indicated two strongly decreasing trends at Scott Creek and Susquehanna River site 44.5, and three increasing trends at Cowanesque River, Ebaughs Creek, and Susquehanna River site 289.1 (Table 17). There was no overall trend with an average weighted value of -0.07 for both concentrations and flow-adjusted concentrations (Tables 18 and 19).

BIOASSESSMENT OF INTERSTATE STREAMS

Abbreviations for water quality standards are provided in Table 20. Summaries of all stations include WQI scores, parameters that exceeded water quality standards, and parameters that exceeded the 90th percentile at each station. RBP III biological and habitat data also are provided, along with graphs depicting historical water quality and biological conditions over the past five years. Fiscal year 1999 WQI scores are indicated by a white bar, and previous WQI scores are indicated by black bars in all WQI graphs.

New York-Pennsylvania Border Streams

Cascade Creek

During fiscal year 1999, Cascade Creek near Lanesboro, Pa., (CASC 1.6) showed a slightly

Table 20. Abbreviations Used in Tables 21 Through 51

Abbreviation	Parameter	Abbreviation	Parameter
ALK	Alkalinity	DNO3	Dissolved Nitrate
COND	Conductivity	TNO3	Total Nitrate
DAl	Dissolved Aluminum	DO	Dissolved Oxygen
TAl	Total Aluminum	DP	Dissolved Phosphorus
TCa	Total Calcium	TP	Total Phosphorus
TCl	Total Chloride	DPO4	Dissolved Orthophosphate
DFe	Dissolved Iron	TPO4	Total Orthophosphate
TFe	Total Iron	DS	Dissolved Solids
TMg	Total Magnesium	TS	Total Solids
DMn	Dissolved Manganese	TSO4	Total Sulfate
TMn	Total Manganese	TOC	Total Organic Carbon
DNH3	Dissolved Ammonia	TURB	Turbidity
TNH3	Total Ammonia	WQI	Water Quality Index
DNO2	Dissolved Nitrite	RBP	Rapid Bioassessment Protocol
TNO2	Total Nitrite		

impaired macroinvertebrate community. This stream was designated moderately impaired during the 1998 fiscal year.

During the 1999 sampling season, Cascade Creek had a high WQI score for a Group 2 New York-Pennsylvania stream. Water quality standards for total and dissolved iron were exceeded, and water quality analysis indicated that dissolved oxygen (DO) levels were reduced (Table 21). The low DO and marginal macroinvertebrate community may be due to low flow conditions during July 1998, which can cause stress on the biological community, or to poor habitat conditions at the site.

Trowbridge Creek

Trowbridge Creek at Great Bend, Pa., (TROW 1.8) had a slightly impaired biological community after being designated moderately impaired during fiscal year 1998. Impaired conditions at this site may be due to low flow conditions at the time of sampling. The location of the site also may contribute to the impaired designation of the site. TROW 1.8 is located directly adjacent to a road, which may lead to an influx of pollutants. Additionally, chemically treated grass clippings were deposited in the stream, as reported by local residents.

TROW 1.8 had the lowest WQI score (21) of any New York-Pennsylvania border stream. However, DO and alkalinity exceeded the 90th percentile (Table 22). Although alkalinity is chronically low at TROW 1.8, it did not exceed standards during fiscal year 1999.

Snake Creek

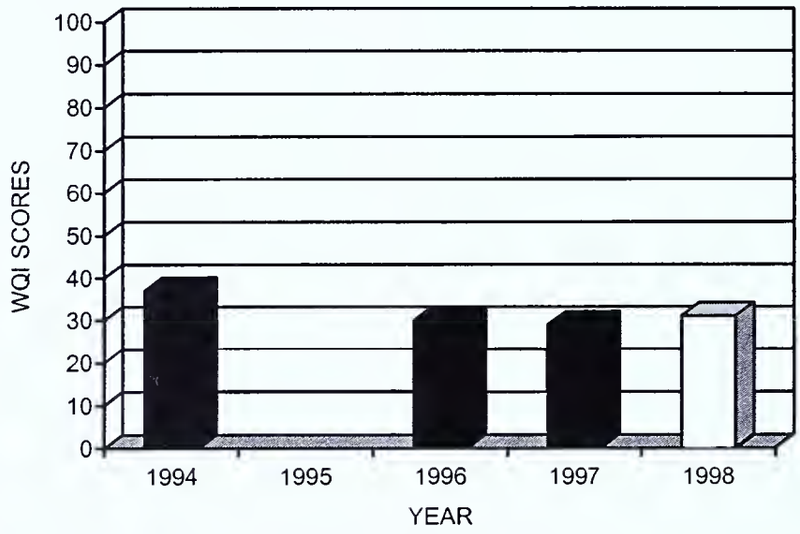
Snake Creek at Brookdale, Pa., (SNAK 2.3) served as the reference site for New York-Pennsylvania border streams. This site had an excellent biological community and physical habitat, with one of the lowest WQI scores of the Group 2 New York-Pennsylvania streams (Table 23). Snake Creek supported many pollution-intolerant taxa, including *Atherix* (Diptera: Athericidae), *Ameletus* (Ephemeroptera: Ameletidae), *Epeorus* (Ephemeroptera: Heptageniidae), *Isonychia* (Ephemeroptera: Isonychiidae), *Paraleptophlebia* (Ephemeroptera: Leptophlebiidae), *Nigronia* (Megaloptera: Corydalidae), and *Leuctra* (Plecoptera: Leuctridae).

Table 21. Water Quality Summary Cascade Creek at Lanesboro, Pa.

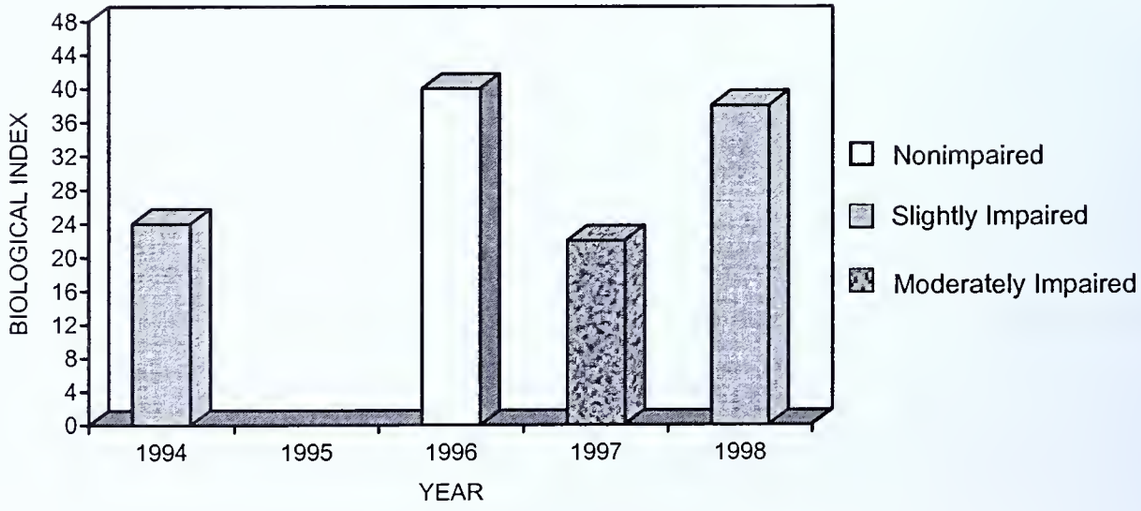
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	07/27/98	1,050 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
DFe	07/27/98	432 µg/l	300 µg/l	Pa. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/27/98	32	DO	TFe						

Biological and Habitat Summary	
Number of Taxa	19
Diversity Index	3.55
RBP III Score	38
RBP III Condition	Slightly Impaired
Total Habitat Score	82
Habitat Condition Category	Partially Supporting



Water Quality Index



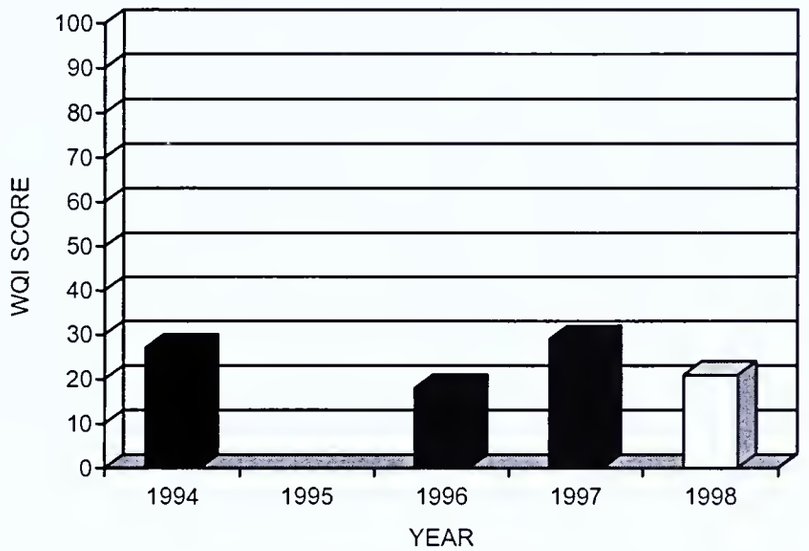
Biological Index

Table 22. Water Quality Summary Trowbridge Creek at Great Bend, Pa.

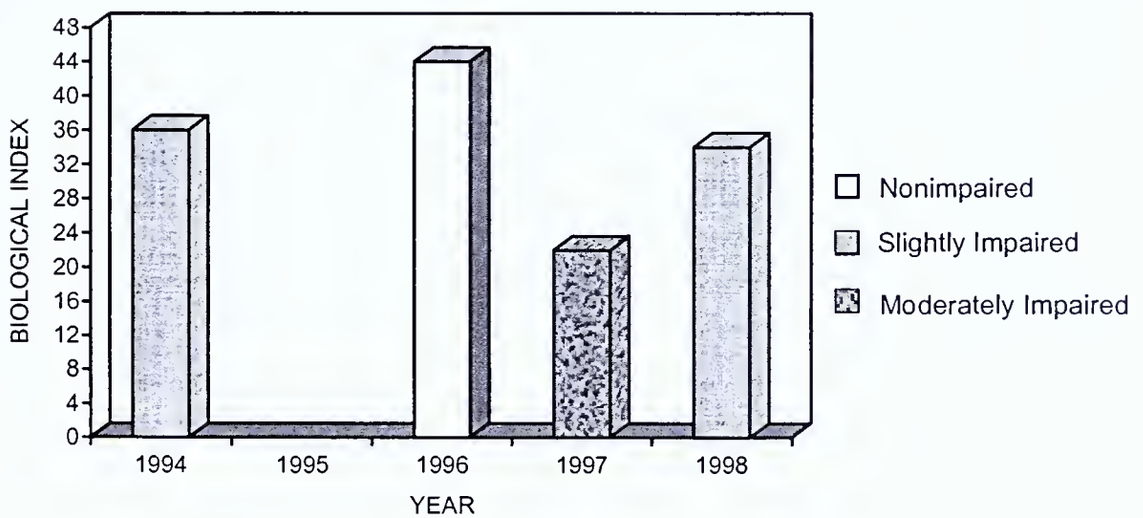
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/27/98	21	DO	ALK						

Biological and Habitat Summary	
Number of Taxa	19
Diversity Index	3.07
RBP III Score	34
RBP III Condition	Slightly Impaired
Total Habitat Score	80
Habitat Condition Category	Partially Supporting



Water Quality Index



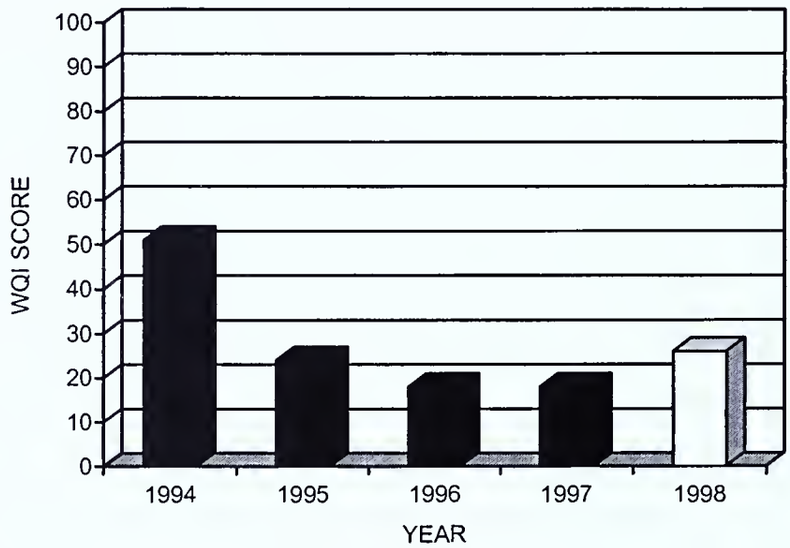
Biological Index

Table 23. Water Quality Summary Snake Creek at Brookdale, Pa.

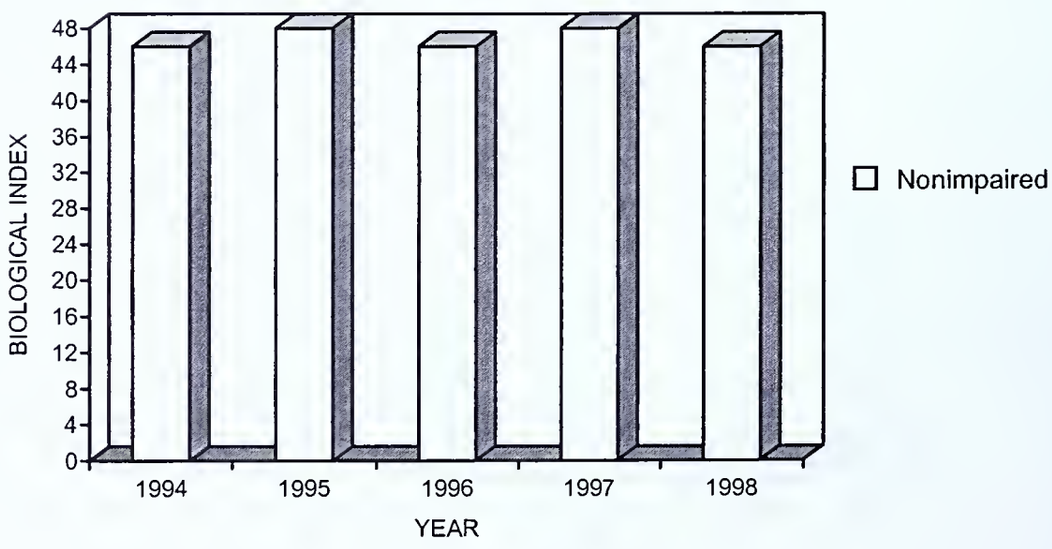
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/28/98	26	DO							

Biological and Habitat Summary	
Number of Taxa	25
Diversity Index	3.90
RBP III Score	46
RBP III Condition	Reference
Total Habitat Score	118
Habitat Condition Category	Reference



Water Quality Index



Biological Index

Little Snake Creek

Little Snake Creek at Brackney, Pa., (LSNK 7.6) showed a slightly impaired biological community after having a moderately impaired biological community during fiscal year 1998. The impairment may have been due to low flow conditions at the time of sampling.

Total and dissolved iron exceeded water quality standards during July 1998 (Table 24). Additionally, LSNK 7.6 had one of the highest WQI scores among the annually sampled New York-Pennsylvania streams, with total and dissolved iron exceeding the 90th percentile.

Choconut Creek

During fiscal year 1999, the biological community of Choconut Creek at Vestal Center, N.Y., (CHOC 9.1) was designated nonimpaired for the second consecutive year. CHOC 9.1 had several pollution-intolerant taxa, including *Atherix*, *Epeorus*, *Isonychia*, *Ophiogomphus* (Odonata: Gomphidae), *Leuctra*, and *Acroneuria* (Plecoptera: Perlidae).

No parameters exceeded standards during July 1998, and water quality analysis indicated that water quality conditions were comparable to the reference site. No parameters exceeded the 90th percentile (Table 25). Impairment during 1996 may have been due to rechannelization, as evidenced by large amounts of riprap at the site.

Apalachin Creek

Apalachin Creek at Little Meadows, Pa., (APAL 6.9) showed a nonimpaired biological community during fiscal year 1999, an improvement from a slightly impaired designation in the previous year. Past impairment conditions may have been due to low flow conditions at the time of sampling. Additionally, very little riffle habitat is present at the site due to still-water conditions, which may affect the biological community.

Total iron exceeded water quality standards during July 1998. However, no parameters exceeded the 90th percentile and the WQI score was moderate for a Group 2 New York-Pennsylvania border stream (Table 26).

Wappasening Creek

A nonimpaired biological community was present at Wappasening Creek at Nichols, N.Y., (WAPP 2.6) during fiscal year 1999. WAPP 2.6 had a slightly impaired biological community during the previous year. Water quality conditions at this site were comparable to the reference site, with no parameters exceeding the 90th percentile standards (Table 27).

Cayuta Creek

Biological conditions of Cayuta Creek at Waverly, N.Y., (CAYT 1.7) were designated nonimpaired, and increase from slightly impaired conditions in the previous year. There were no water quality standards exceeded during fiscal year 1999 at CAYT 1.7. However, water quality analysis indicated that Cayuta Creek at Waverly contained elevated concentrations of total and dissolved nitrates, total and dissolved phosphorus, total and dissolved orthophosphates, total and dissolved solids, and total chlorides (Table 28).

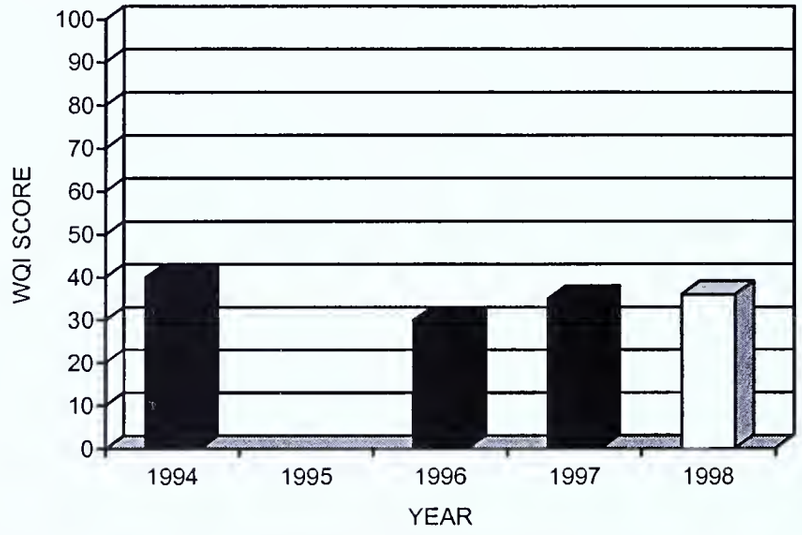
Poor water quality conditions may be due to a variety of causes, including wastewater discharges from the Waverly sewage treatment facility, runoff from the city of Waverly, failure of upstream septic systems, or runoff from agriculture. More detailed studies would need to be performed to determine the cause of impairment. In spite of elevated water quality parameters, CAYT 1.7 contained several pollution-intolerant taxa, including *Atherix*, *Serratella* (Ephemeroptera: Ephemerellidae), *Epeorus*, *Isonychia*, *Nigronia*, and *Acroneuria*.

Table 24. Water Quality Summary Little Snake Creek at Brackney, Pa.

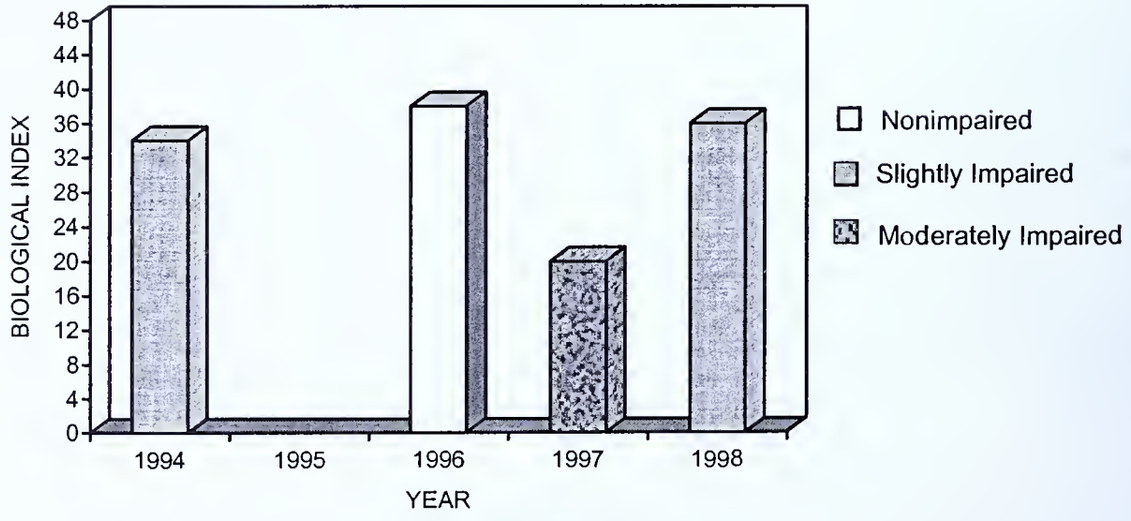
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
TFe	07/28/98	966 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
DFe	07/28/98	544 µg/l	300 µg/l	Pa. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/28/98	36	TFe	DFe						

Biological and Habitat Summary	
Number of Taxa	19
Diversity Index	3.62
RBP III Score	36
RBP III Condition	Slightly Impaired
Total Habitat Score	105
Habitat Condition Category	Supporting



Water Quality Index



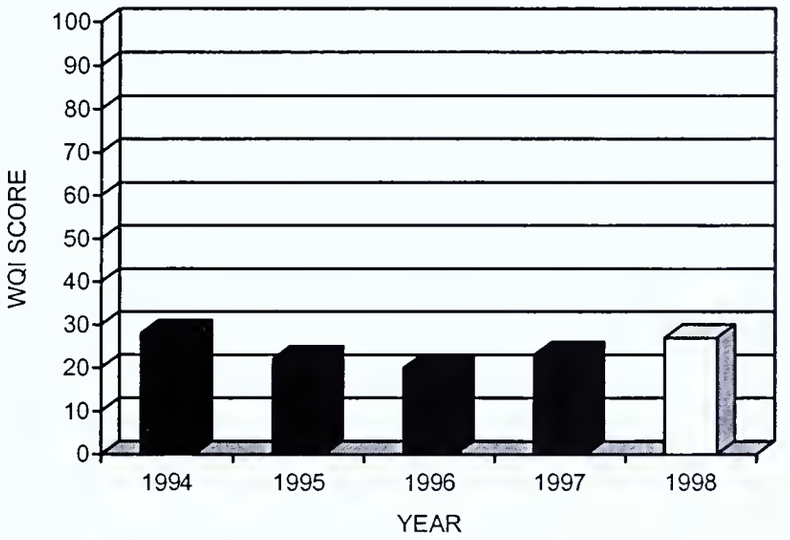
Biological Index

Table 25. Water Quality Summary Choconut Creek at Vestal Center, N.Y.

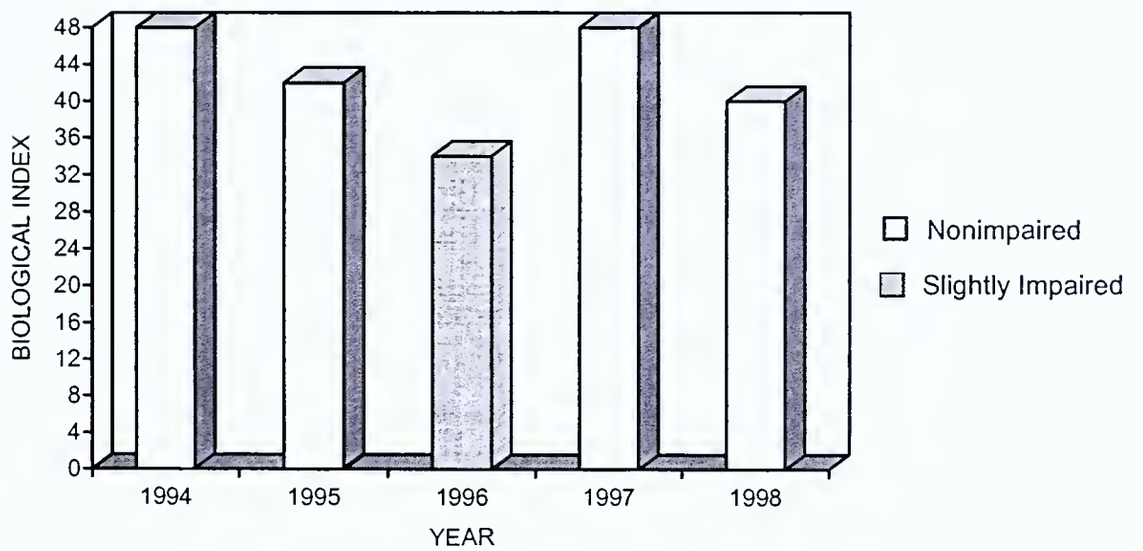
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/28/98	27								

Biological and Habitat Summary	
Number of Taxa	18
Diversity Index	3.52
RBP Score	40
RBP Condition	Nonimpaired
Total Habitat Score	99
Habitat Condition Category	Supporting



Water Quality Index



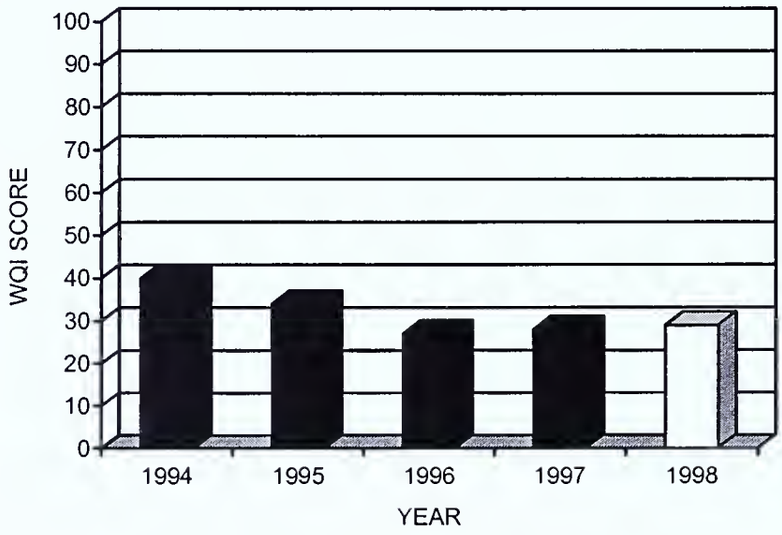
Biological Index

Table 26. Water Quality Summary Apalachin Creek at Little Meadows, Pa.

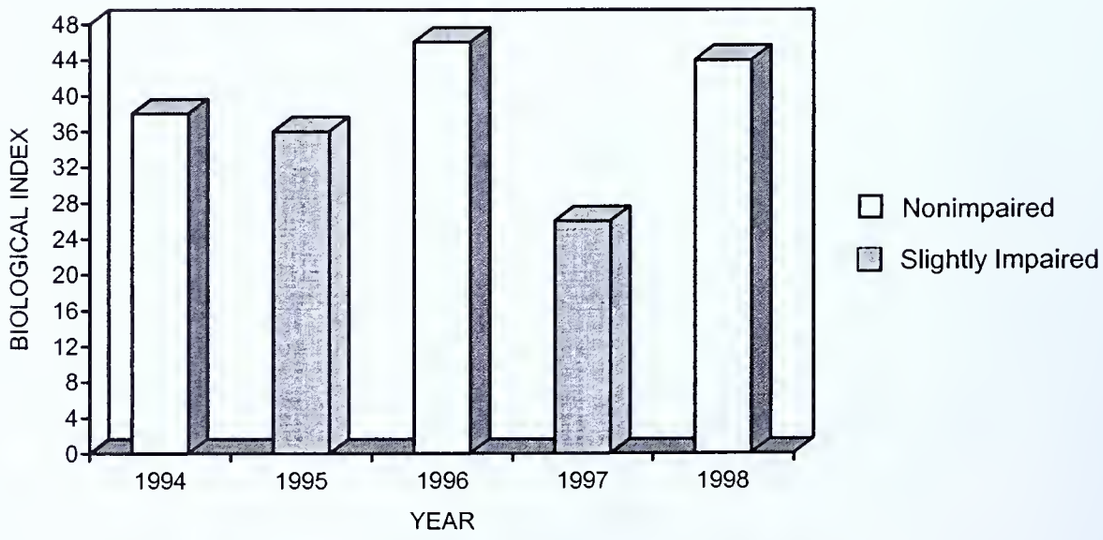
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	07/28/98	495 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/28/98	29								

Biological and Habitat Summary	
Number of Taxa	23
Diversity Index	3.75
RBP Score	44
RBP Condition	Nonimpaired
Total Habitat Score	76
Habitat Condition Category	Partially Supporting



Water Quality Index



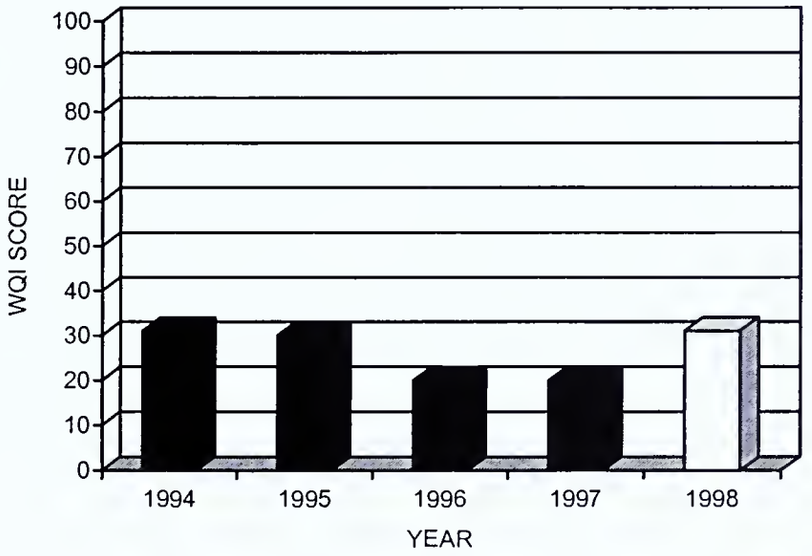
Biological Index

Table 27. Water Quality Summary Wappasening Creek at Nichols, N.Y.

Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/28/98	31								

Biological and Habitat Summary	
Number of Taxa	24
Diversity Index	3.78
RBP Score	46
RBP Condition	Nonimpaired
Total Habitat Score	99
Habitat Condition Category	Supporting



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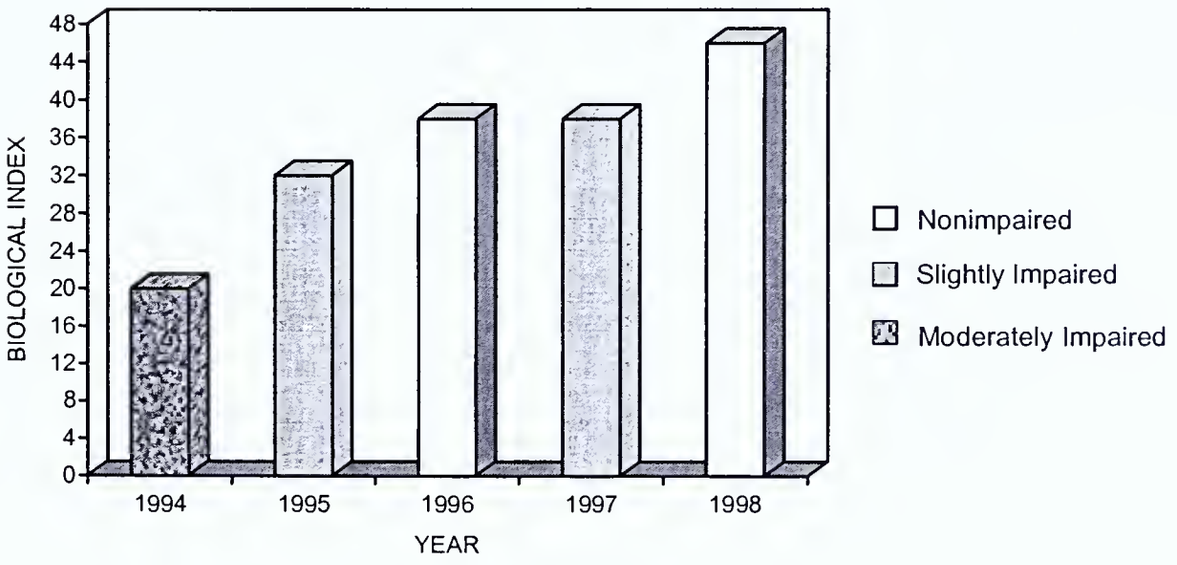


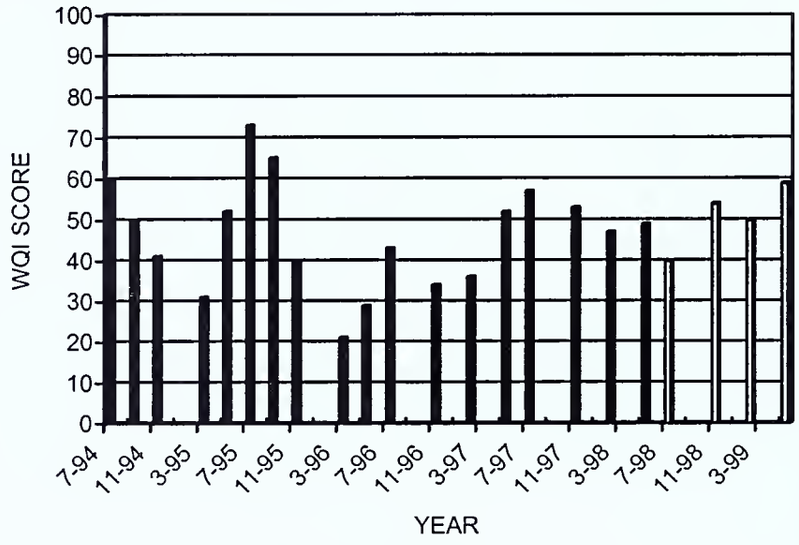
Biological Index

Table 28. Water Quality Summary Cayuta Creek at Waverly, N.Y.

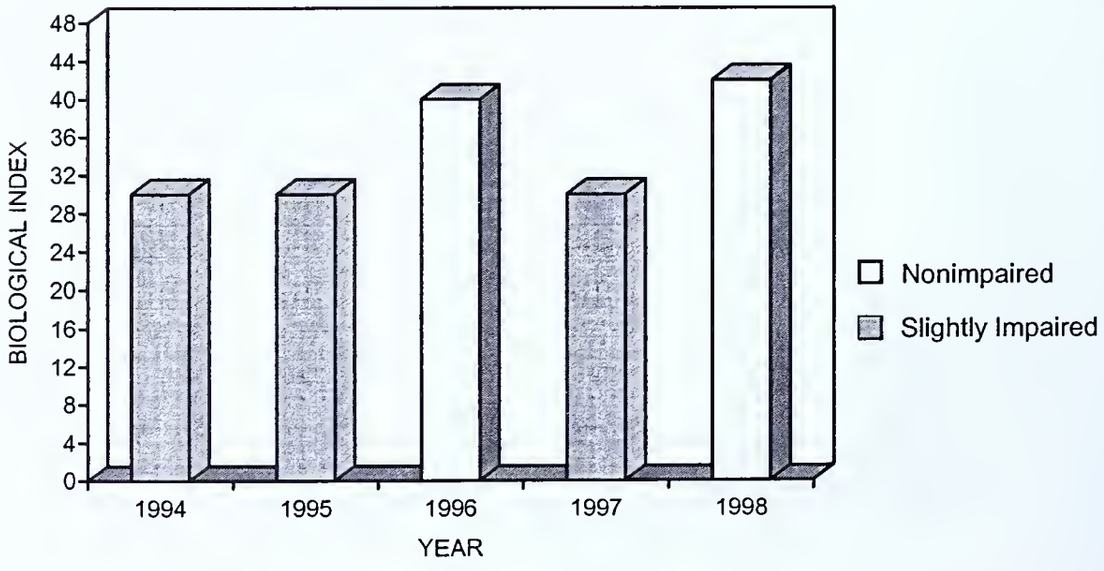
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/29/98	40	TCa							
11/11/98	54	DO	DNO3	TNO3	TP	DP	DPO4	TPO4	
02/16/99	50	DO	DS						
05/12/99	59	COND	TS	TP	DP	DPO4	TCl	TPO4	

Biological and Habitat Summary	
Number of Taxa	19
Diversity Index	3.64
RBP Score	42
RBP Condition	Nonimpaired
Total Habitat Score	90
Habitat Condition Category	Supporting



Water Quality Index



Biological Index

Cayuta Creek showed several downward trends for total concentrations. Total solids and the WQI showed significant decreasing trends ($0.05<p<0.10$), while strong, significant decreasing trends ($p<0.05$) were observed for total ammonia, total phosphorus, total sulfate, total iron, and total manganese (Table 17). When flow-adjusted concentrations were calculated, total ammonia showed a significant decreasing trend, while total solids, total nitrogen, total phosphorus, total sulfate, and total manganese showed strong, significant decreasing trends (Table 17).

Bentley Creek

A slightly impaired biological community existed at Bentley Creek at Wellsburg, N.Y., (BNTY 0.9). Biological conditions at BNTY 0.9 have been poor for the past ten years. Impairment may have been due to rechannelization of the stream or to low flow conditions at the time of sampling. The habitat at this site is considered nonsupporting and heavily altered.

Water quality in Bentley Creek was comparable to the reference with no parameters exceeding water quality standards or the 90th percentile (Table 29).

South Creek

During fiscal year 1999, South Creek at Fassett, Pa., (SOUT 7.8) showed a nonimpaired biological community. For the previous eight years, a slightly to moderately impaired macroinvertebrate population had inhabited this site.

Water quality at SOUT 7.8 was good for a Group 2 New York-Pennsylvania stream, with no parameters exceeding standards or the 90th percentile (Table 30). Previous impairment at this site may have been due to periodic drying of the streambed or to poor habitat diversity.

Seeley Creek

Seeley Creek at Seeley Creek, N.Y., (SEEL 10.3) contained a moderately impaired biological community and had shown a slightly to moderately impaired biological community for the past 10 years. Water quality analysis indicated fair water quality conditions in the stream with no parameters exceeding standards, and only total calcium exceeded the 90th percentile (Table 31). The impaired biological community may have been due to flow-related incidents. During periods of low flow, large amounts of instream substrate were exposed in Seeley Creek. Additionally, rechannelization and removal of the instream habitat may have contributed to impairment at this site, as these activities reduced the habitat quality of the site. Habitat conditions at this site were considered nonsupporting.

New York State Department of Conservation (NYSDEC) listed Seeley Creek as "threatened" in its publication, The 1998 Chemung River Basin Waterbody Inventory and Priority Waterbodies List (NYSDEC, 1998). According to this publication, the stream is threatened by habitat alteration, streambank erosion, and instability of the stream channel. SRBC's findings concur with this statement.

Holden Creek

Holden Creek near Woodhull, N.Y., (HLDN 3.5) had a nonimpaired biological community during fiscal year 1999. Previously, the biological conditions of Holden Creek had not been sampled since July 1990. At that time, HLDN 3.5 had a slightly impaired biological community.

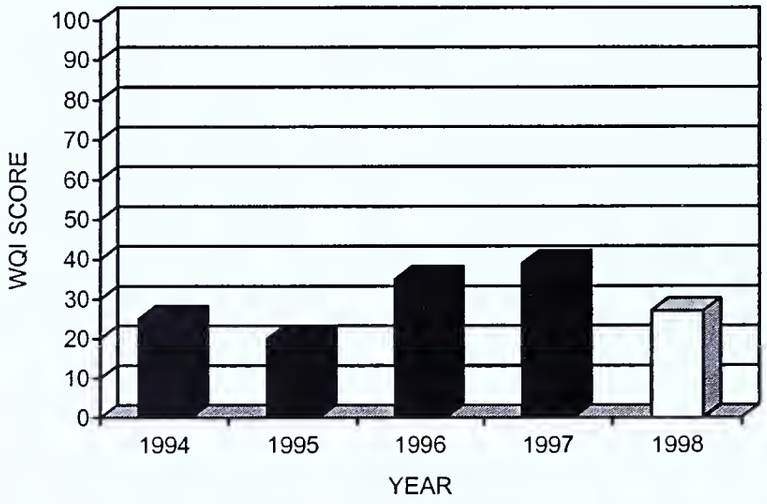
Water quality in Holden Creek was poor for a Group 2 New York-Pennsylvania border stream. However, no parameters exceeded water quality standards, and only total magnesium exceeded the 90th percentile (Table 32). Habitat was somewhat degraded at HLDN 3.5 with a "partially supporting" designation.

Table 29. Water Quality Summary Bentley Creek at Wellsburg, N.Y.

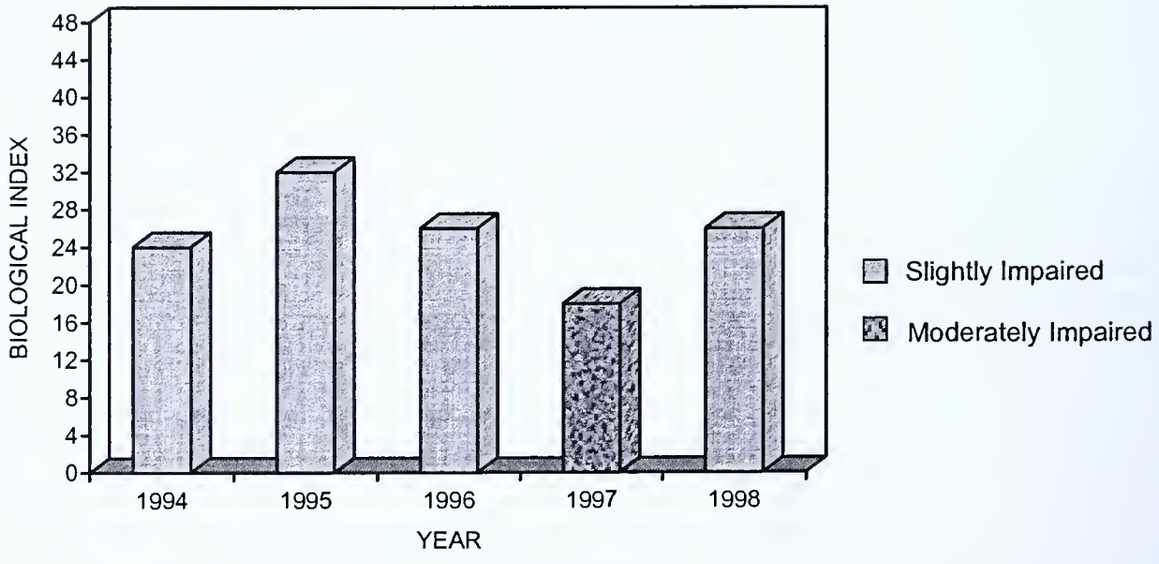
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/29/98	27								

Biological and Habitat Summary	
Number of Taxa	13
Diversity Index	2.76
RBP III Score	26
RBP III Condition	Slightly Impaired
Total Habitat Score	70
Habitat Condition Category	Nonsupporting



Water Quality Index



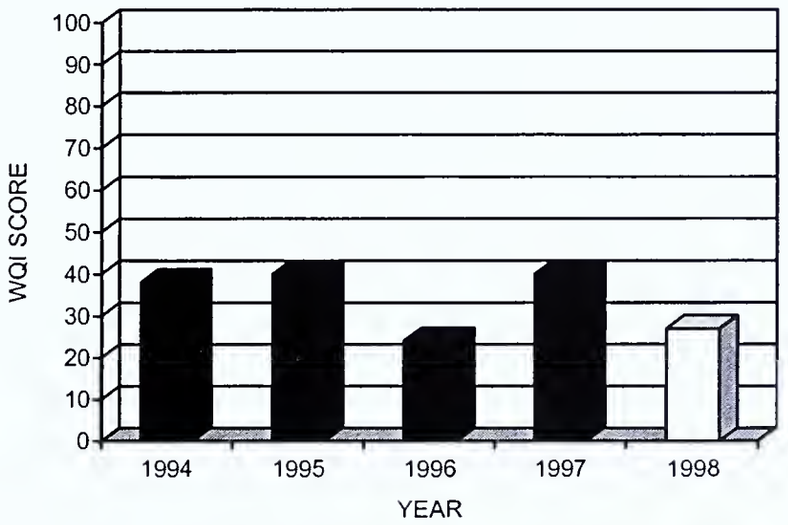
Biological Index

Table 30. Water Quality Summary South Creek at Fassett, Pa.

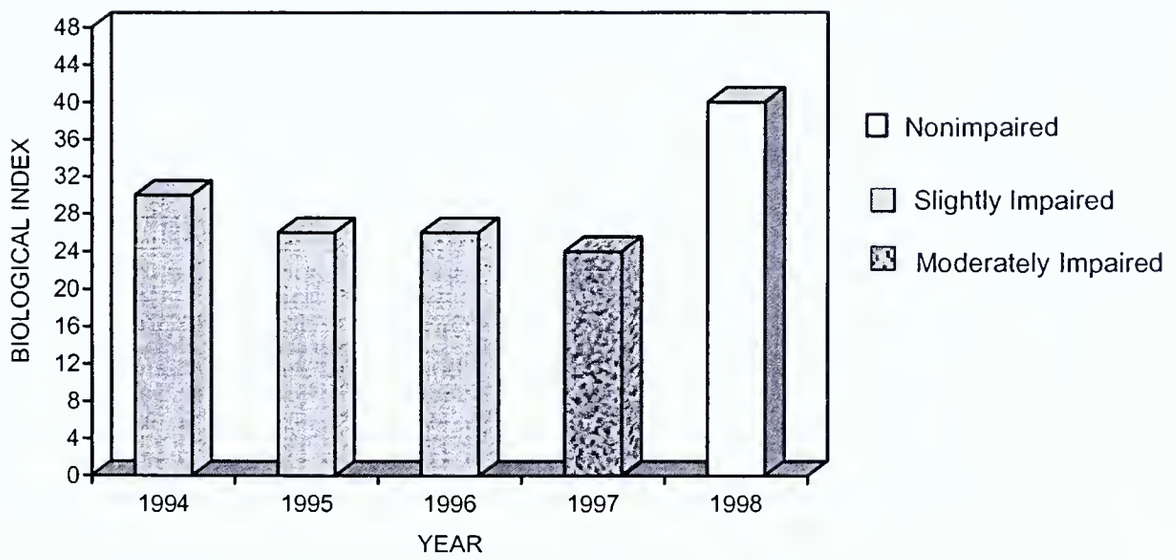
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/29/98	27								

Biological and Habitat Summary	
Number of Taxa	20
Diversity Index	3.41
RBP III Score	40
RBP III Condition	Nonimpaired
Total Habitat Score	99
Habitat Condition Category	Supporting



Water Quality Index



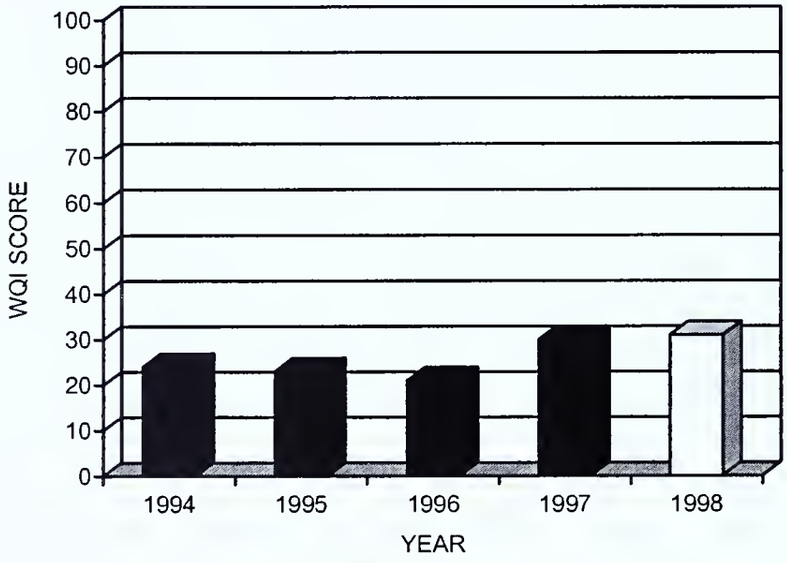
Biological Index

Table 31. Water Quality Summary Seeley Creek at Seeley Creek, N.Y.

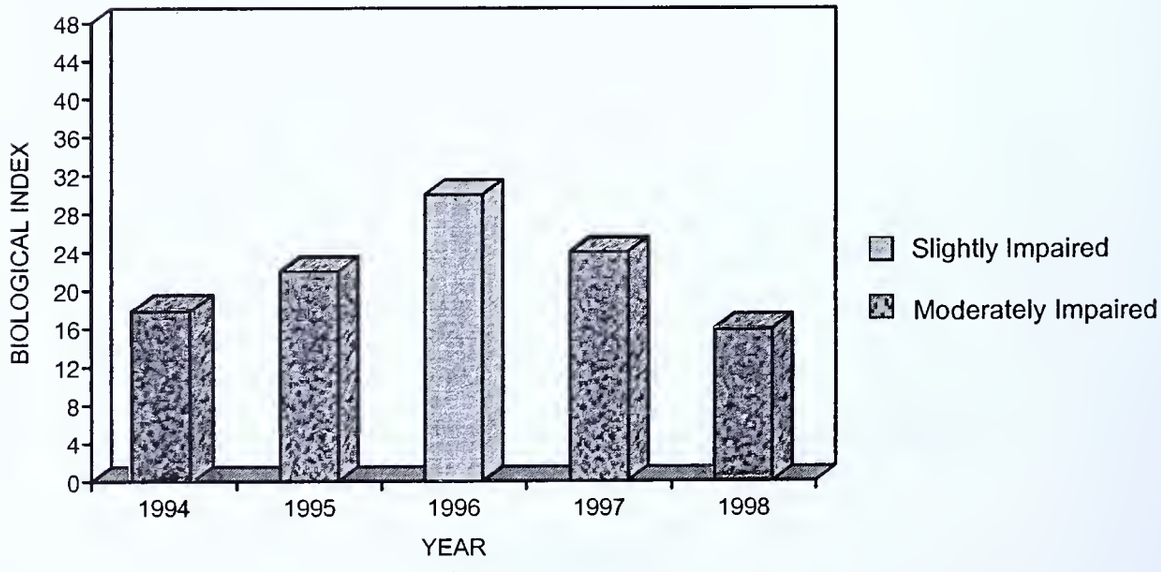
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/29/98	31	TCa							

Biological and Habitat Summary	
Number of Taxa	12
Diversity Index	1.87
RBP III Score	16
RBP III Condition	Moderately Impaired
Total Habitat Score	65
Habitat Condition Category	Nonsupporting



Water Quality Index



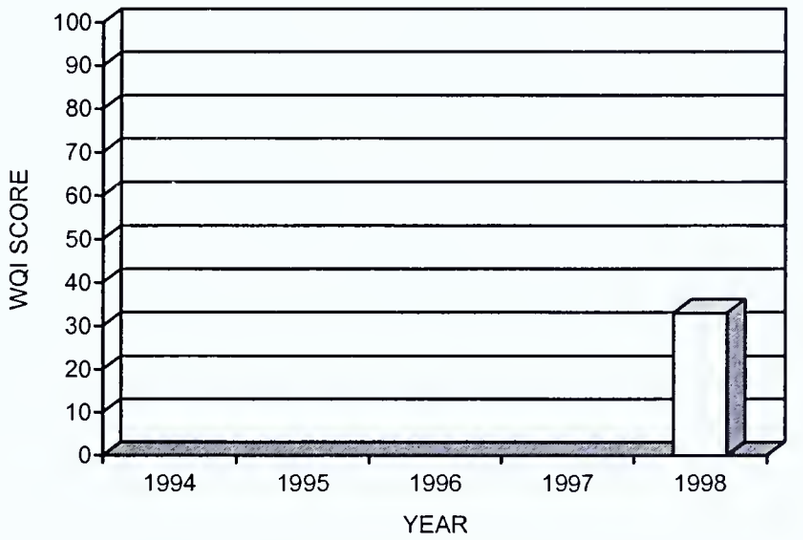
Biological Index

Table 32. Water Quality Summary Holden Creek at Woodhull, N.Y.

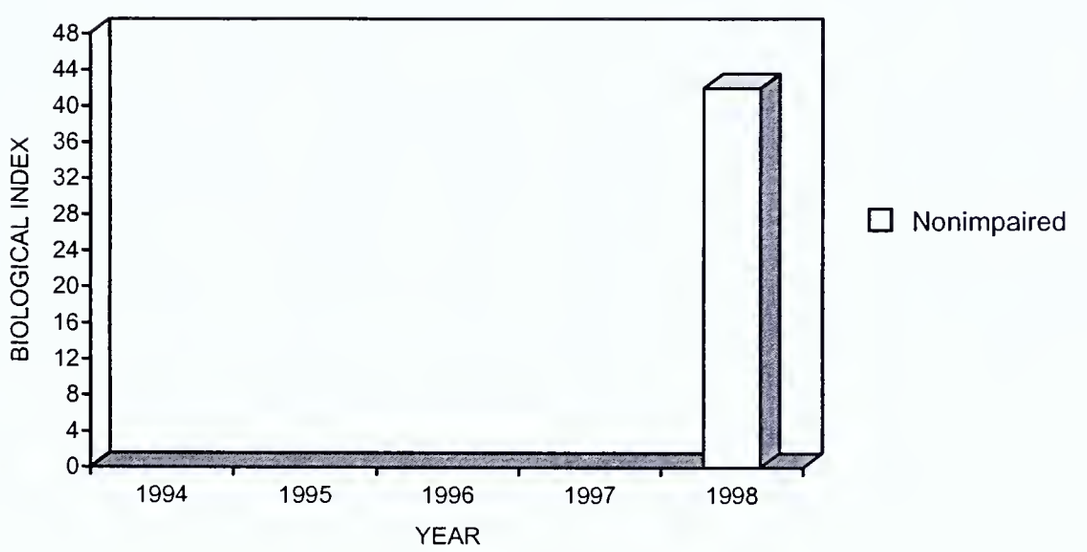
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/30/98	33	TMg							

Biological and Habitat Summary	
Number of Taxa	22
Diversity Index	3.76
RBP Score	42
RBP Condition	Nonimpaired
Total Habitat Score	75
Habitat Condition Category	Partially Supporting



Water Quality Index



Biological Index

Troups Creek

Troups Creek at Austinburg, Pa., (TRUP 4.5) had a moderately impaired biological community during July 1998 after slightly impaired conditions existed the previous year. This is the third time in five years that Troups Creek has contained a moderately impaired macro-invertebrate population.

Water quality in Troups Creek was degraded during the sampling period. Total iron exceeded New York State standards in February 1999. Additional water quality analysis indicated that a variety of parameters exceeded the 90th percentile, including dissolved oxygen, nitrates, phosphorus, and orthophosphates (Table 33).

Troups Creek showed a strong, significant decreasing trend in total sulfate in both concentrations and flow-adjusted concentrations (Table 17).

North Fork Cowanesque River

A slightly impaired biological community was present at North Fork Cowanesque River at North Fork, Pa., (NFCR 7.6) during fiscal year 1999. Previously, SRBC had not sampled the biological conditions of North Fork Cowanesque River since July 1992. At that time, NFCR 7.6 had a nonimpaired biological community. Although slightly impaired conditions existed during July 1998, North Fork Cowanesque River had the greatest diversity of macroinvertebrates of any New York-Pennsylvania stream with several pollution-intolerant taxa, including *Atherix*, *Hexatoma* (Diptera: Tipulidae), *Ameletus*, *Nigronia*, *Ophiogomphus*, *Leuctra*, *Agnetina* (Plecoptera: Perlidae), and *Brachycentrus* (Trichoptera: Brachycentridae).

Poor water quality conditions existed at NFCR 7.6 during this sampling period. Total iron exceeded New York State water quality standards during July 1998. Further water quality analysis indicated high levels of nutrients, including nitrates, phosphorus, and orthophosphates (Table 34). Agricultural activities in the watershed may be affecting the water quality of North Fork Cowanesque River.

Pennsylvania-Maryland Streams

Long Arm Creek

For the fourth consecutive year, Long Arm Creek at Bandanna, Pa., (LNGA 2.5) had a slightly impaired biological community. LNGA 2.5 was located adjacent to agricultural activities, which may have been the source of impairment at this site. Livestock in the stream reduced the habitat quality in Long Arm Creek, which may have affected the biological community.

Long Arm Creek showed elevated nitrogen values, as did most of the streams in this region. Overall, the water quality in this stream was poor for a Pennsylvania-Maryland Group 2 stream (Table 35). Although no water quality standards were exceeded, total iron, total aluminum, and turbidity exceeded the 90th percentile at this site.

South Branch Conewago Creek

South Branch Conewago Creek near Bandanna, Pa., (SBCC 20.4) contained a slightly impaired biological community for the second consecutive year, after having served as the Pennsylvania-Maryland reference site for several years. However, several pollution-intolerant taxa inhabited SBCC 20.4, including *Hexatoma*, *Paraleptophlebia*, *Nigronia*, *Leuctra*, *Acroneuria*, and *Dolophilodes* (Trichoptera: Philopotamidae).

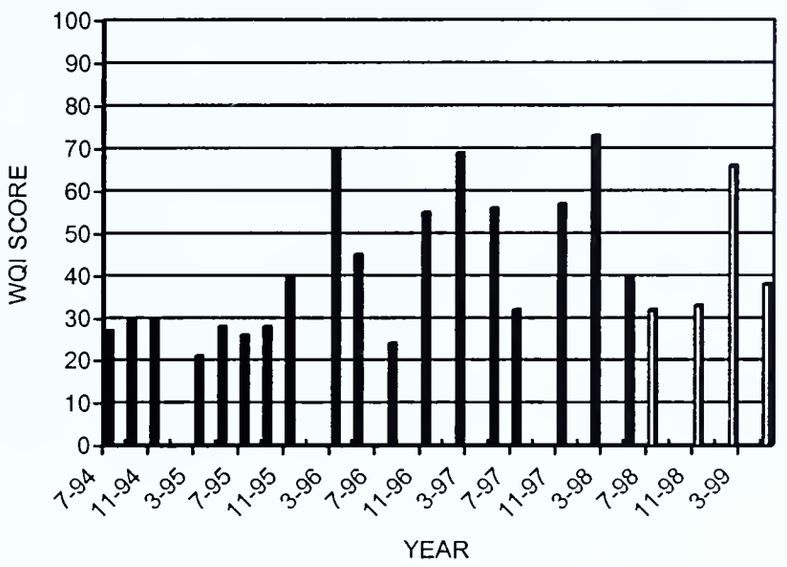
SBCC 20.4 had the lowest WQI score of the Group 2 Pennsylvania-Maryland sites. No parameters exceeded standards or the 90th percentile at South Branch Conewago Creek (Table 36). Low flow conditions at the time of sampling may have affected the biological community and produced a slightly impaired designation. Habitat conditions also are not optimal at this site.

Table 33. Water Quality Summary Troups Creek at Austinburg, Pa.

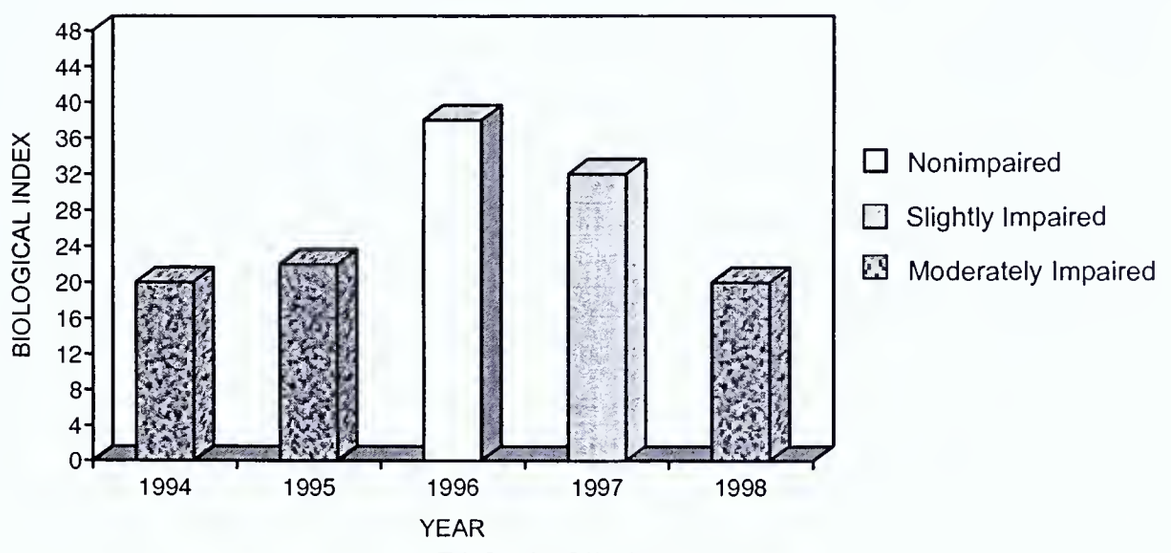
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
TFe	02/17/99	920 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/30/98	32	TNH3							
11/12/98	33	DO	DNO3	TNO3	TP	DP	DPO4	TPO4	
02/17/99	66	DO	ALK	TNO2	TFe	TAl	TPO4	TURB	
05/13/99	38	TOC							

Biological and Habitat Summary	
Number of Taxa	17
Diversity Index	3.85
RBP Score	20
RBP Condition	Moderately Impaired
Total Habitat Score	91
Habitat Condition Category	Supporting



Water Quality Index



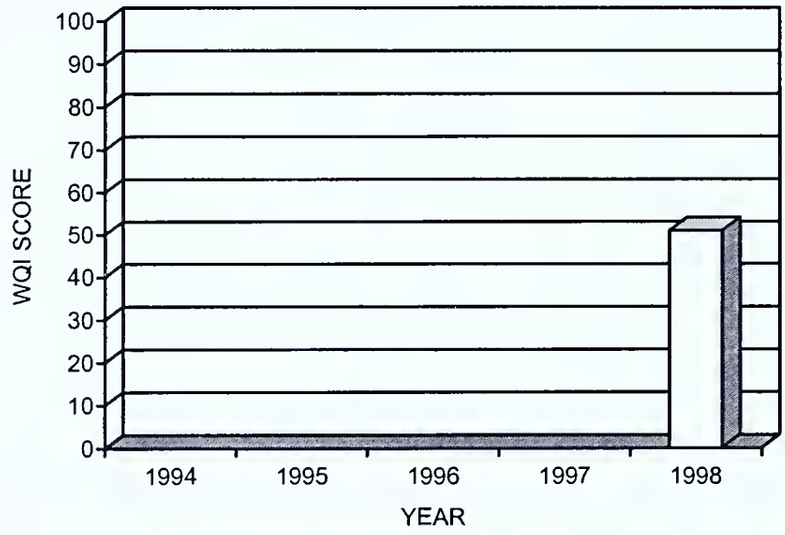
Biological Index

Table 34. Water Quality Summary North Fork Cowanesque River at North Fork, Pa.

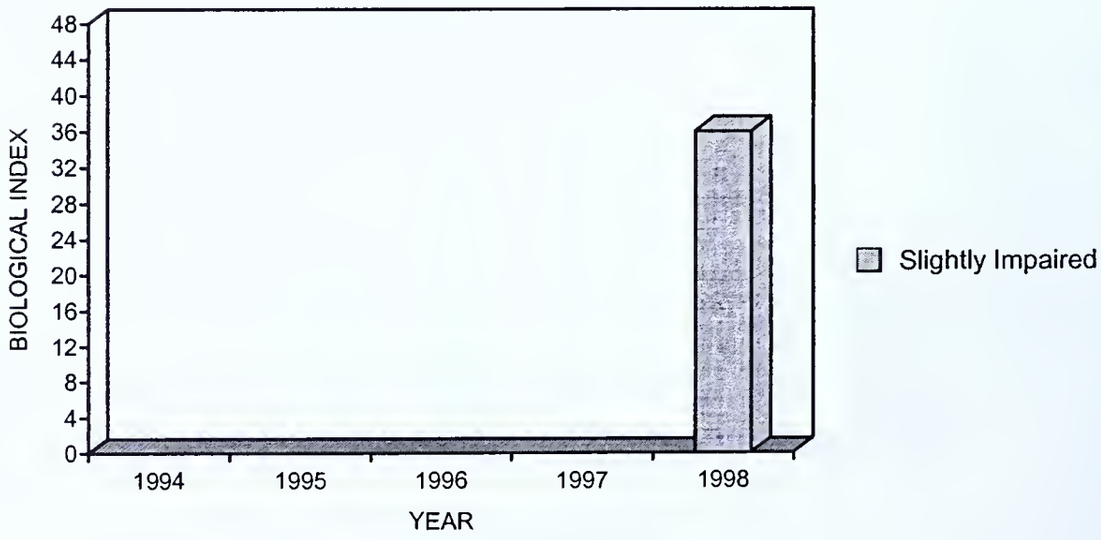
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
TFe	07/30/98	470 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/30/98	51	DNO3	TNO3	TP	DP	DPO4	TPO4		

Biological and Habitat Summary	
Number of Taxa	26
Diversity Index	3.29
RBP Score	36
RBP Condition	Slightly Impaired
Total Habitat Score	109
Habitat Condition Category	Excellent



Water Quality Index



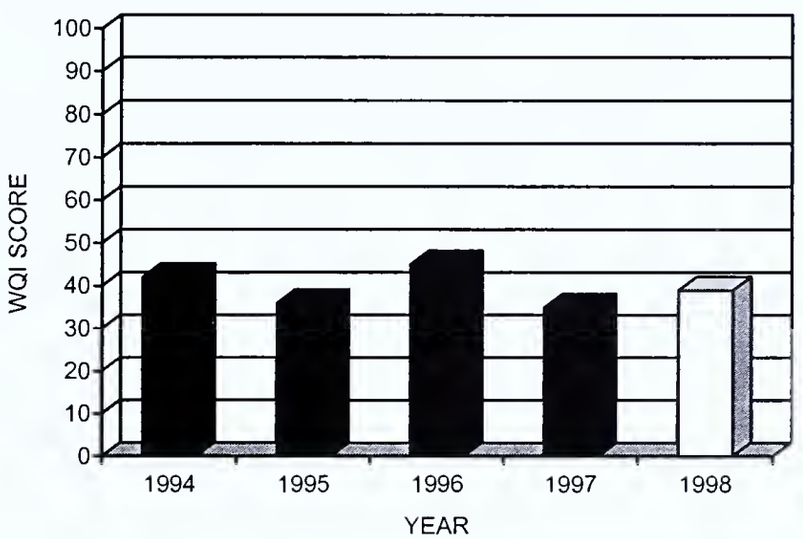
Biological Index

Table 35. Water Quality Summary Long Arm Creek at Bandanna, Pa.

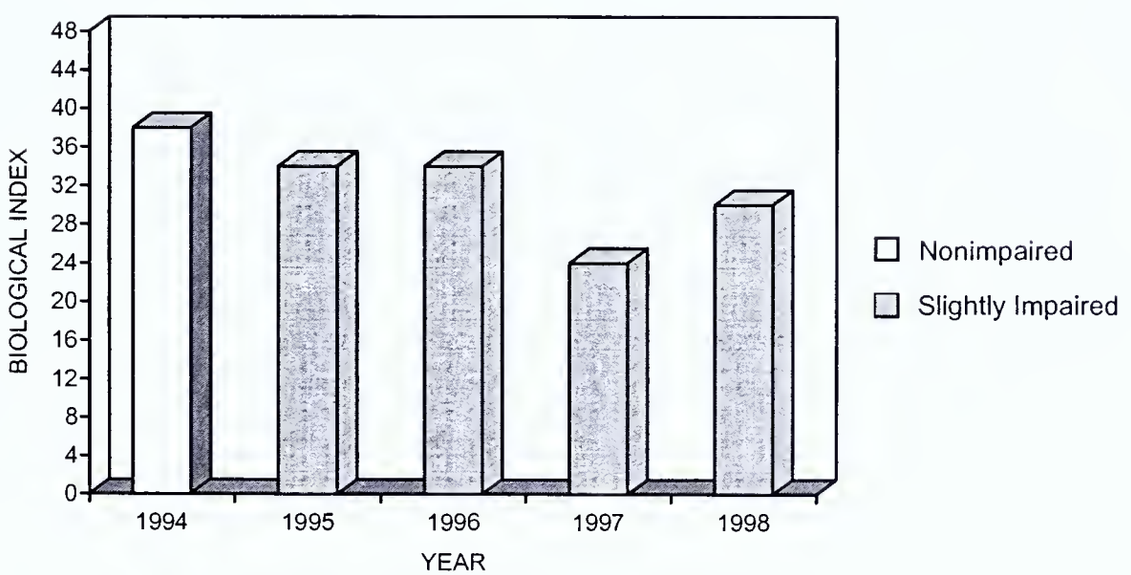
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/03/98	39	TFe	TAl	TURB					

Biological and Habitat Summary	
Number of Taxa	17
Diversity Index	3.21
RBP III Score	30
RBP III Condition	Slightly Impaired
Total Habitat Score	71
Habitat Condition Category	Partially Supporting



Water Quality Index



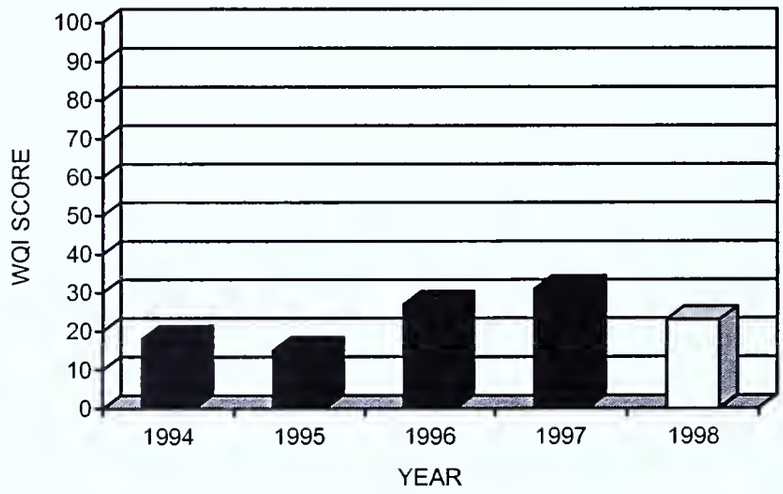
Biological Index

Table 36. Water Quality Summary South Branch Conewago Creek at Bandanna, Pa.

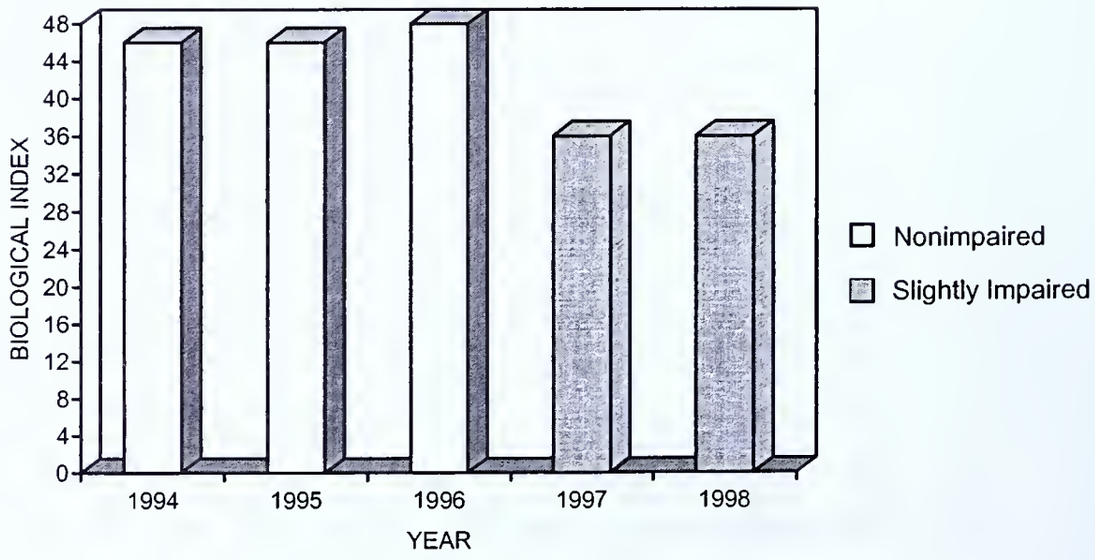
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/03/98	23								

Biological and Habitat Summary	
Number of Taxa	17
Diversity Index	3.69
RBP III Score	36
RBP III Condition	Slightly Impaired
Total Habitat Score	100
Habitat Condition Category	Supporting



Water Quality Index



Biological Index

Deer Creek

Deer Creek at Gorsuch Mills, Md., (DEER 44.2) had a slightly impaired macroinvertebrate community during 1998 after having a nonimpaired community for two years. Although habitat conditions at the site were considered excellent, the sampling site is located adjacent to agricultural activities, which may affect the biological community at DEER 44.2. Deer Creek had the lowest average WQI score (33) and the lowest individual WQI score (30) of Group 1 streams in this region. Water quality at this site was good (Table 37), although nitrate levels were somewhat elevated, as they were in most streams in this area. Dissolved oxygen also exceeded the 90th percentile during April 1999. Deer Creek harbored a diverse macroinvertebrate community, including pollution-intolerant taxa such as *Atherix*, *Serratella*, *Epeorus*, *Isonychia*, *Nigronia*, *Acroneuria*, *Agnetina*, and *Dolophilodes*.

Deer Creek showed a mixture of increasing and decreasing trends during the period 1986 through 1999. Strong, significant upward trends were found for flow-adjusted and unadjusted concentrations of total chloride. Significant increasing trends occurred in flow-adjusted and unadjusted concentrations of total nitrogen and unadjusted total sulfate. Strong, significant decreasing trends occurred in both unadjusted and flow-adjusted total phosphorus and total iron and unadjusted total ammonia, total manganese, and WQI (Table 17).

Ebaughs Creek

For the tenth year, Ebaughs Creek near Stewartstown, Pa., (EBAU 1.5) had a slightly to moderately impaired biological community. Physical habitat at this site was considered supporting during the 1999 fiscal year and the biological community was designated slightly impaired.

Although no water quality standards were exceeded, Ebaughs Creek had elevated concentrations of chloride, ammonia, and nitrites and low alkalinity (Table 38). EBAU 1.5 also showed elevated nitrate values. The relatively high WQI, low RBP III scores, and the chemical analysis suggested that wastewater discharges might have affected the water quality and the biological community at this site.

Ebaughs Creek had a mixture of upward and downward water quality trends. Strong, significant increasing trends occurred for both unadjusted and flow-adjusted concentrations of total solids and total chlorides, as well as unadjusted WQI. Significant increasing trends occurred for flow-adjusted WQI. Strong significant decreasing trends were found for both unadjusted and flow-adjusted concentrations of total phosphorus, total iron, and total manganese as well as unadjusted ammonia (Table 17).

Big Branch Deer Creek

Big Branch Deer Creek at Fawn Grove, Pa., (BBDC 4.1) served as the reference site for the Pennsylvania-Maryland border streams during the 1998 sampling season. This site had the best combination of biological community and physical habitat of the Pennsylvania-Maryland streams. A large number of organic pollution-intolerant taxa inhabited this site, including *Epeorus*, *Stenonema* (Ephemeroptera: Heptageniidae), *Isonychia*, *Nigronia*, *Ophiogomphus*, *Leuctra*, *Acroneuria*, *Agnetina*, *Eccoptura* (Plecoptera: Perlidae), *Dolophilodes*, and *Rhyacophila* (Trichoptera: Rhyacophilidae). Alkalinity exceeded standards during August 1998; however, overall water quality was good in Big Branch Deer Creek (Table 39).

Falling Branch Deer Creek

The biological community of Falling Branch Deer Creek near Fawn Grove, Pa., (FBDC 4.1) was designated slightly impaired for the second consecutive year. The impairment may have been due to poor habitat, low flow conditions, runoff from cropland adjacent to the site, and the large amount of agricultural activity in the small watershed.

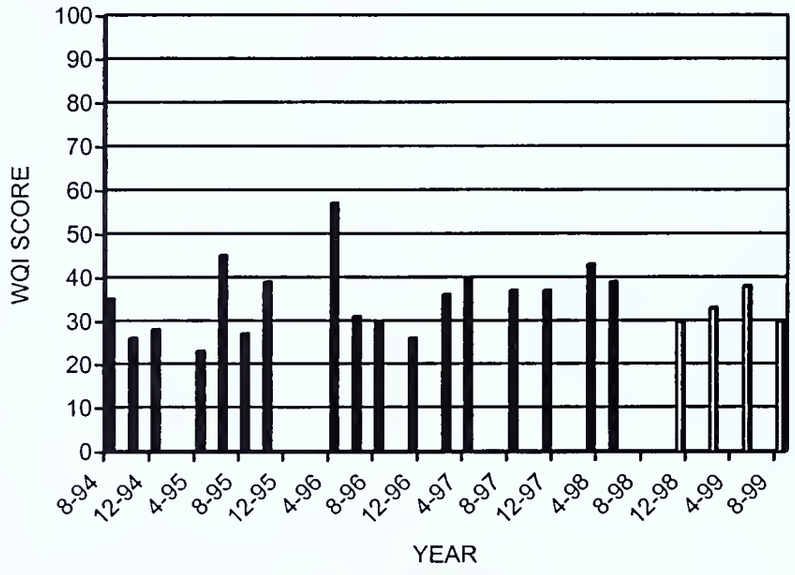
Alkalinity exceeded Pennsylvania standards for aquatic life during August 1998. Overall,

Table 37. Water Quality Summary Deer Creek at Gorsuch Mills, Md.

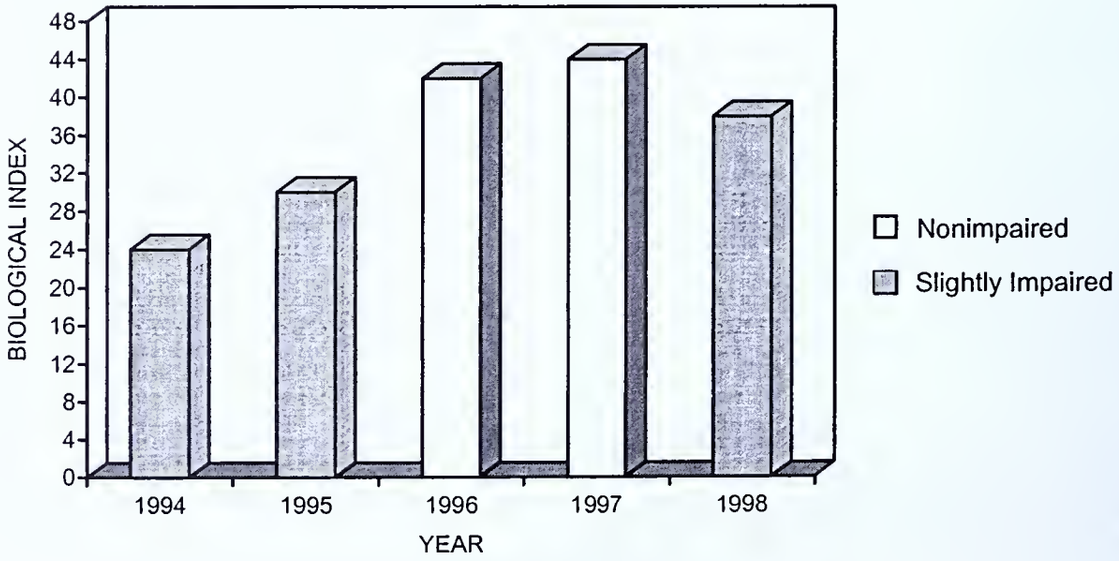
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/04/98	30								
11/05/98	30								
02/10/99	33								
04/27/99	38	DO							

Biological and Habitat Summary	
Number of Taxa	22
Diversity Index	3.74
RBP Score	38
RBP Condition	Slightly Impaired
Total Habitat Score	104
Habitat Condition Category	Excellent



Water Quality Index



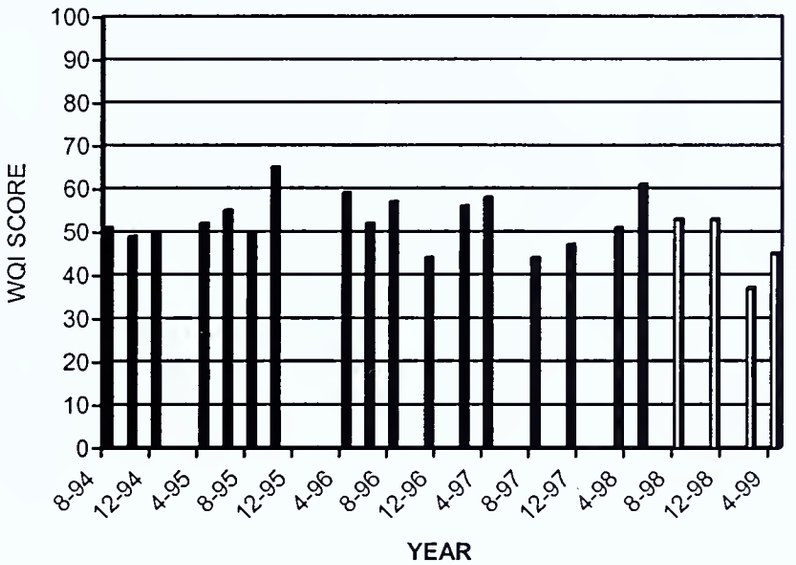
Biological Index

Table 38. Water Quality Summary Ebaughs Creek at Stewartstown, Pa.

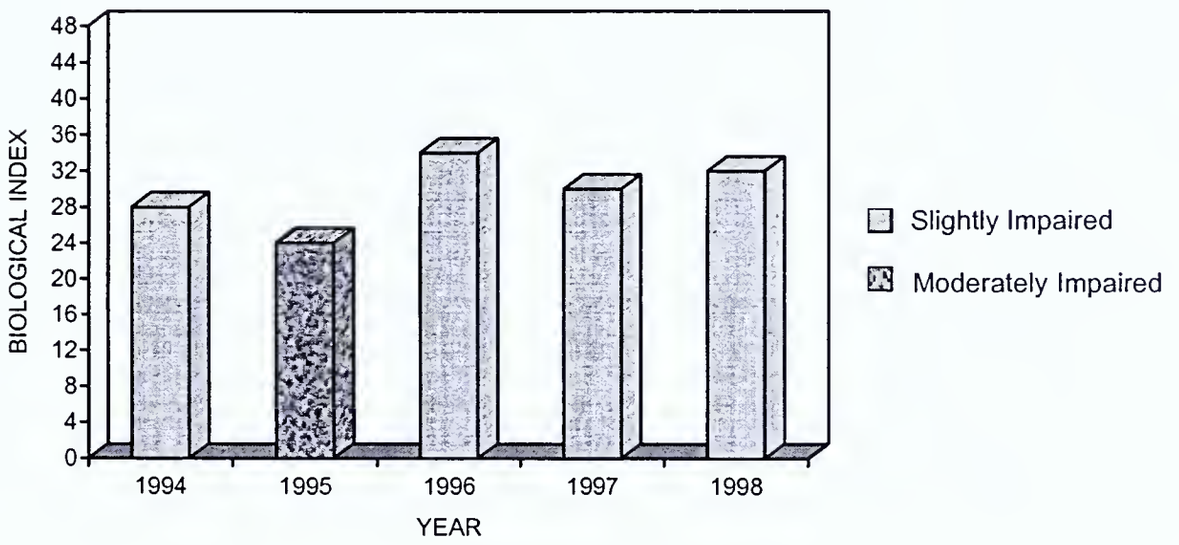
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/04/98	53	COND	TCa	TCl	DFe				
11/05/98	53	ALK	TNH3	DNO2	TNO2	DP			
02/10/99	37	DO	ALK						
04/27/99	45	DO	ALK						

Biological and Habitat Summary	
Number of Taxa	18
Diversity Index	3.30
RBP Score	32
RBP Condition	Slightly Impaired
Total Habitat Score	95
Habitat Condition Category	Supporting



Water Quality Index



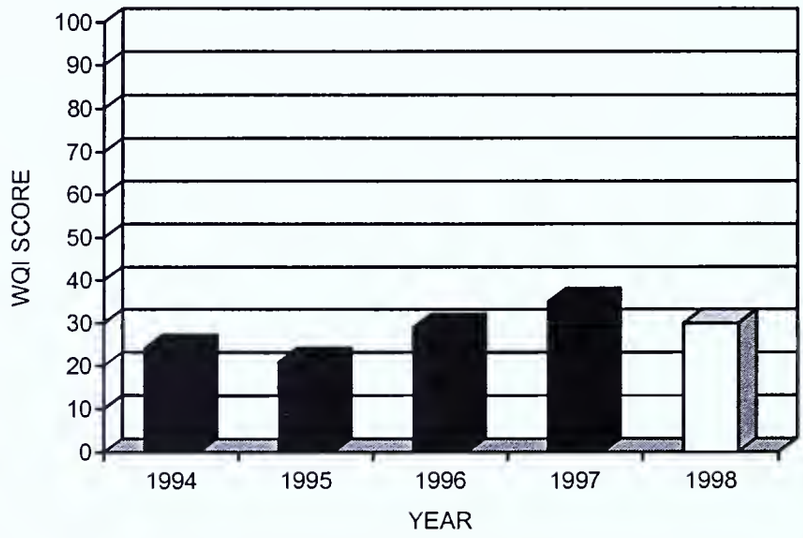
Biological Index

Table 39. Water Quality Summary Big Branch Deer Creek at Fawn Grove, Pa.

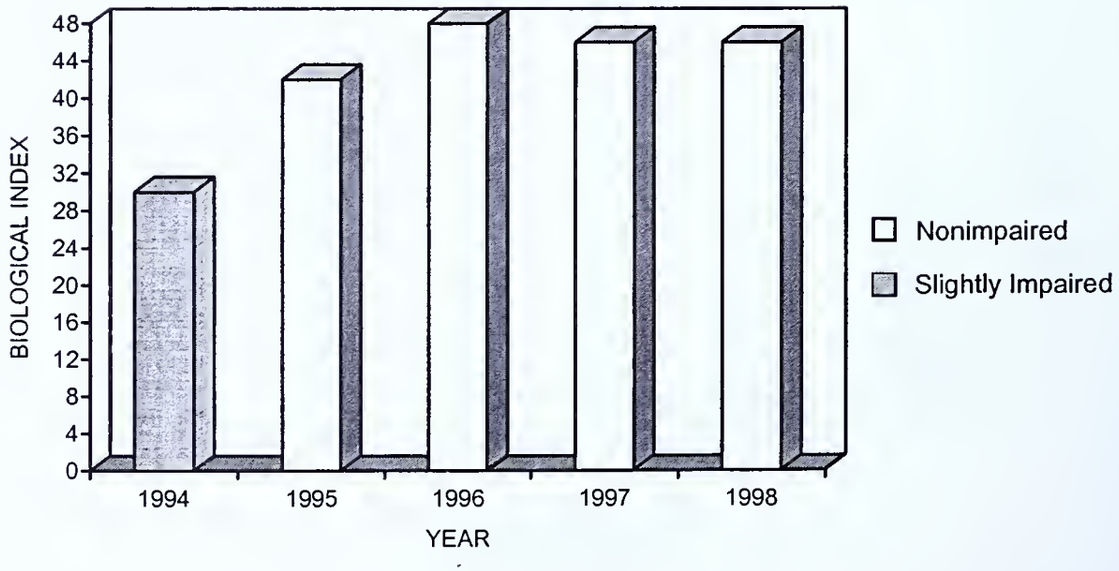
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
ALK	08/04/98	14 mg/l	20 mg/l	Pa. aquatic life

Date	**WQI**	**Parameters Exceeding 90th Percentile**							
08/04/98	30	ALK							

Biological and Habitat Summary	
Number of Taxa	21
Diversity Index	3.76
RBP Score	46
RBP Condition	Reference
Total Habitat Score	112
Habitat Condition Category	Reference



Water Quality Index



Biological Index

water quality appeared to be good with only alkalinity exceeding the 90th percentile at this site (Table 40).

Scott Creek

For the tenth consecutive year, Scott Creek at Delta, Pa., (SCTT 3.0) had a moderately- to severely-impaired biological community. During fiscal year 1999, Scott Creek had a severely impaired macroinvertebrate community, with the lowest taxonomic richness (4), lowest diversity index (1.48), highest Hilsenhoff Biotic Index (7.44), lowest EPT index (1), and the highest percent dominant taxa (54) of all streams in the region. Habitat at this site was also poor.

In January 1998, 4 to 5,000 gallons of home heating fuel spilled into Scott Creek in Cardiff, Md., during a failed attempt to steal the fuel. The spill resulted in a fish kill. Although the incident probably had an adverse effect on the aquatic inhabitants, Scott Creek already had impaired conditions for many years.

Dissolved oxygen and total manganese exceeded Pennsylvania State standards during November 1998. Additional water quality analysis indicated that Scott Creek had elevated ammonia, magnesium, chloride, phosphorus, orthophosphates, iron, manganese, and solids, and reduced dissolved oxygen (Table 41). This site also had the highest average WQI score (60) of the streams in this region. Although a wastewater treatment plant was constructed to service the area and reduce the impacts of sewage on the stream, raw sewage from the Cardiff-Delta area may continue to degrade water quality and the biological community of Scott Creek. SCTT 3.0 is located upstream of the wastewater treatment plant for Cardiff and Delta.

Scott Creek had a mixture of increasing and decreasing trends during fiscal year 1999. Using unadjusted concentration values, total nitrogen showed a strong, significant increasing trend, while total phosphorus, total sulfate, total iron, and WQI showed strong, significant decreasing trends (Table 17). When concentrations were flow-adjusted, total nitrogen showed a significant increasing trend, while total phosphorus, total sulfate, total iron, and WQI showed strong, significant decreasing trends (Table 17).

Conowingo Creek

Conowingo Creek at Pleasant Grove, Pa., (CNWG 4.4) had a slightly impaired biological community for the third consecutive year. Habitat at this site was considered excellent.

Although no parameters exceeded state standards, nitrate concentrations were elevated, as they are at many sites in this region. Additional water quality analysis indicated that ammonia, solids, nitrites, and magnesium were elevated (Table 42). Given that agriculture is the area's predominant land use, agricultural runoff may be the source of nutrient enrichment.

Conowingo Creek had a variety of upward and downward trends. Strong significant increasing trends occurred for total nitrogen and total chloride in both unadjusted and flow-adjusted concentrations. Strong, significant decreasing trends were found for total phosphorus, total iron, total aluminum, and total manganese for both unadjusted and flow-adjusted concentrations (Table 17).

Octoraro Creek

Octoraro Creek at Rising Sun, Md., (OCTO 6.6) had a slightly impaired biological community during the 1998 sampling season. The habitat at this site was excellent. However, although no Pennsylvania or Maryland State standards were exceeded, analysis indicated that the water quality of Octoraro Creek was poor. Ammonia, nitrites, phosphorus, orthophosphates, iron, and total organic carbon were elevated (Table 43). OCTO 6.6 also showed elevated nitrate values. High WQI scores may have been due to agricultural activities in the watershed or to the impoundment at Octoraro Lake.

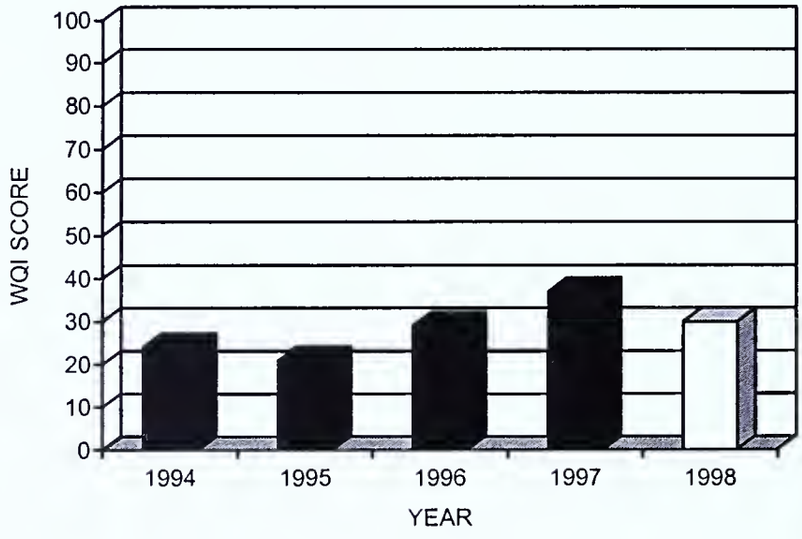
Several increasing and decreasing trends were found at OCTO 6.6. Strong significant increasing trends occurred for total nitrogen and total chloride in unadjusted concentrations. Flow-

Table 40. Water Quality Summary Falling Branch Deer Creek at Fawn Grove, Pa.

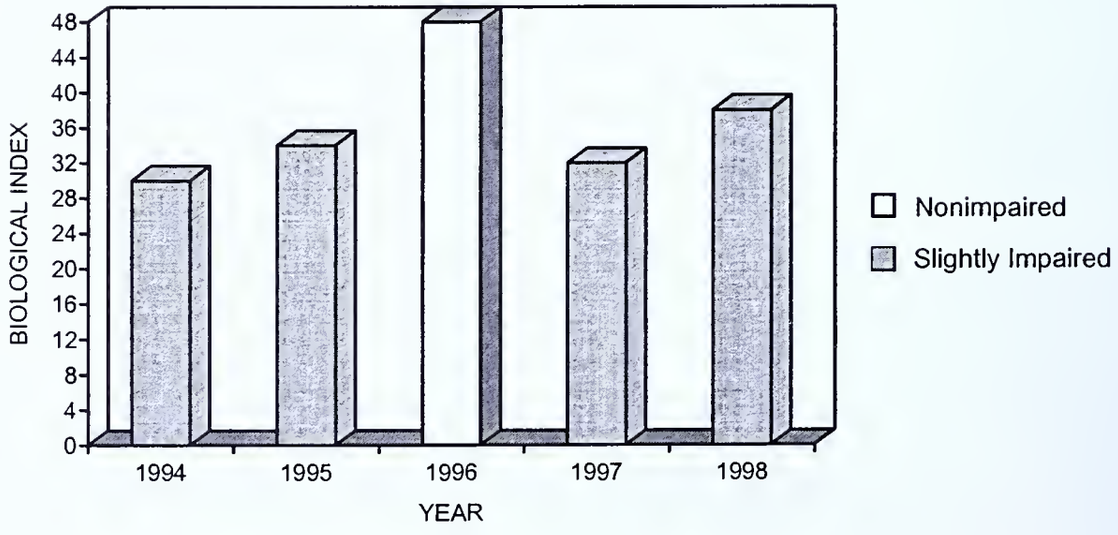
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
ALK	08/04/98	14 mg/l	20 mg/l	Pa. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
08/04/98	30	ALK							

Biological and Habitat Summary	
Number of Taxa	21
Diversity Index	3.75
RBP Score	38
RBP Condition	Slightly Impaired
Total Habitat Score	63
Habitat Condition Category	Nonsupporting



Water Quality Index



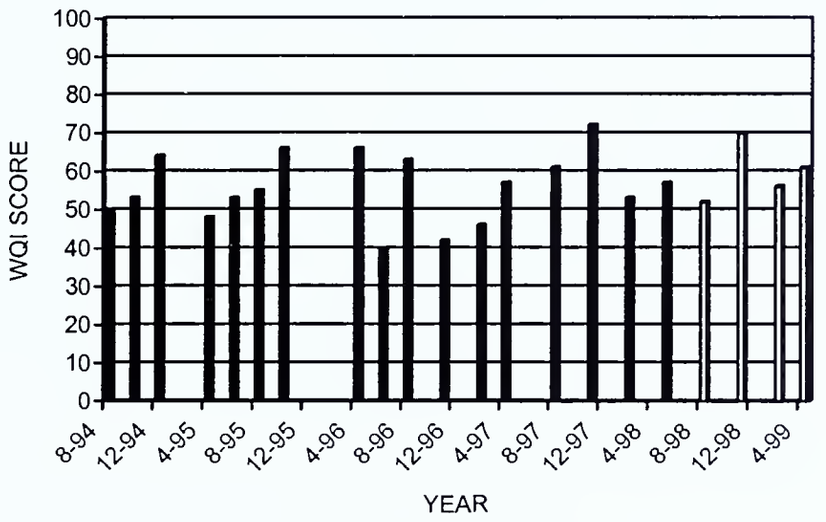
Biological Index

Table 41. Water Quality Summary Scott Creek at Delta, Pa.

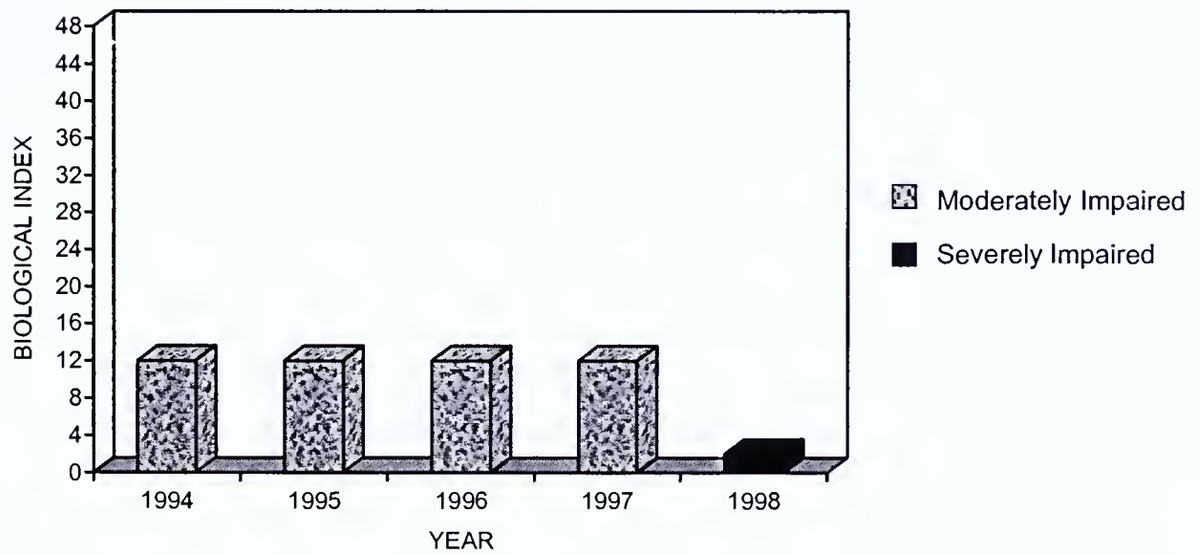
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
DO	11/05/98	3.35 mg/l	4.00 mg/l	Pa. aquatic life
TMn	11/05/98	2,110 µg/l	1,000 µg/l	Pa. water supply

Date	WQI	Parameters Exceeding 90th Percentile							
08/05/98	52	TP	DP	DPO4	TMg	TPO4			
11/05/98	70	DO	DNH3	TP	TOC	TCl	TFe	DFe	TMn
		DMn	TPO4	TURB					
02/10/99	56	DO	COND	TS	DS	TCl	TSO4		
04/27/99	61	COND	DNH3	TNH3	TCa	TMg	TCl		

Biological and Habitat Summary	
Number of Taxa	4
Diversity Index	1.48
RBP III Score	2
RBP III Condition	Severely Impaired
Total Habitat Score	80
Habitat Condition Category	Partially Supporting



Water Quality Index



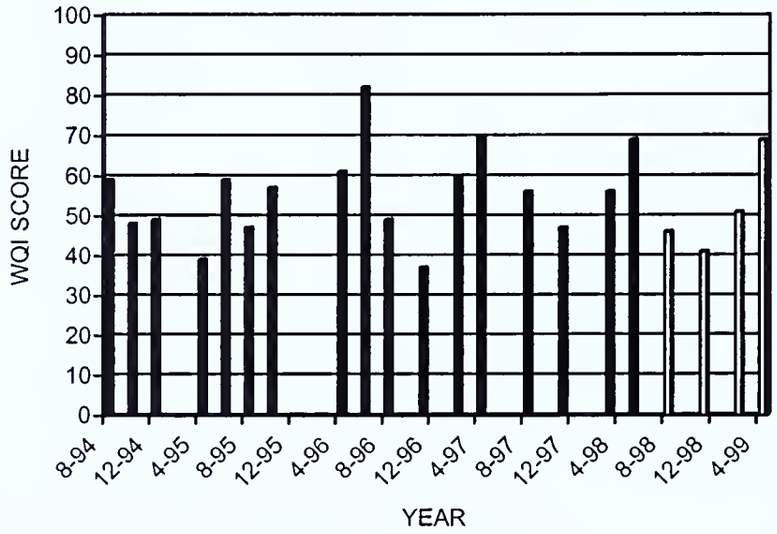
Biological Index

Table 42. Water Quality Summary Conowingo Creek at Pleasant Grove, Pa.

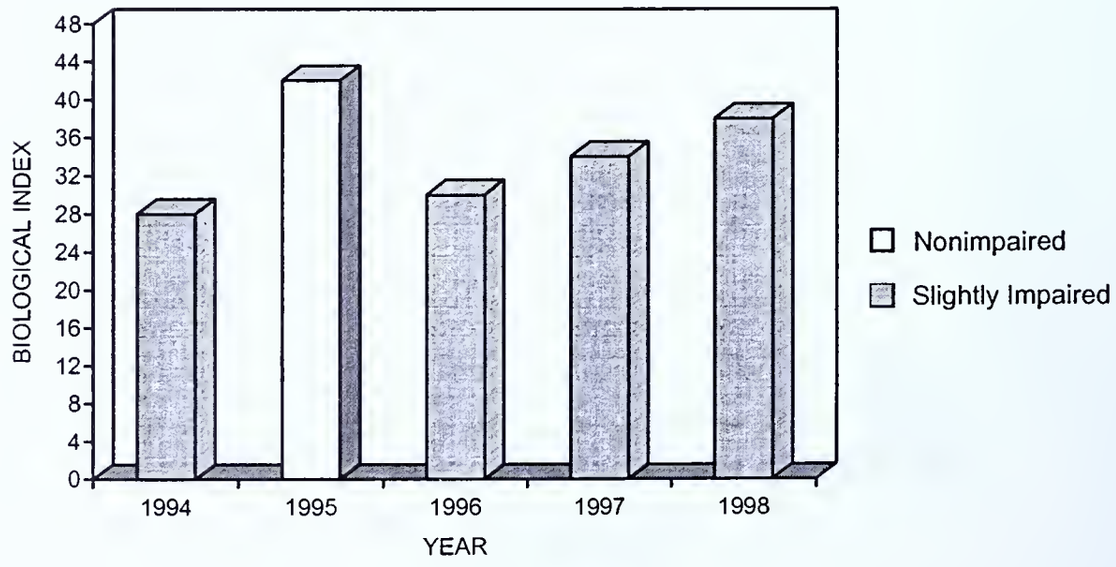
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/06/98	46	DNO3	TNO3	TMg	TFe	TURB			
11/06/98	41	TNH3	DNO3	TNO3					
02/11/99	51	DO	DS	DNO3	TNO3	TMg			
04/28/99	69	DO	TS	DS	DNO2	TNO2	DNO3	TNO3	TMg
		TURB							

Biological and Habitat Summary	
Number of Taxa	18
Diversity Index	3.51
RBP III Score	38
RBP III Condition	Slightly Impaired
Total Habitat Score	119
Habitat Condition Category	Excellent



Water Quality Index



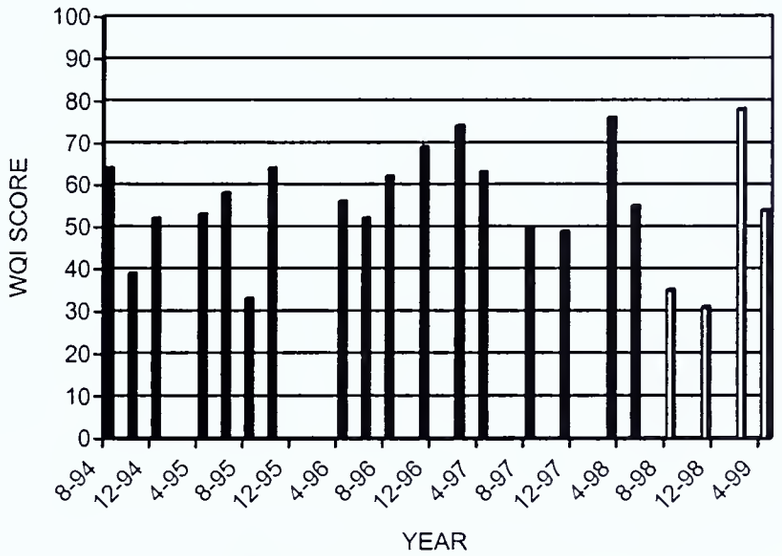
Biological Index

Table 43. Water Quality Summary Octoraro Creek at Rising Sun, Md.

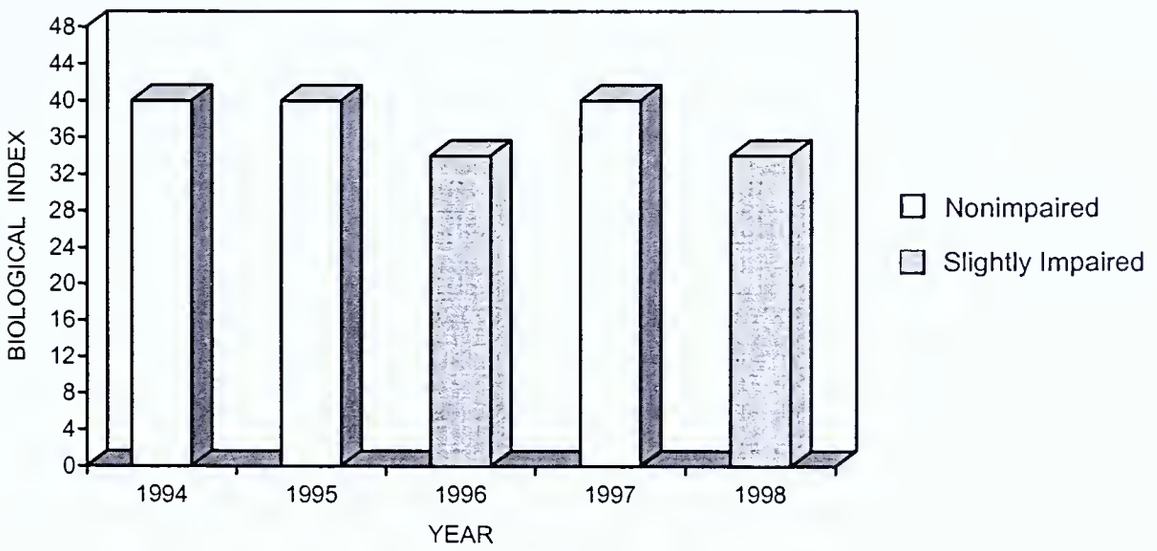
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/05/98	35	TMg							
11/07/98	31								
02/11/99	51	DNH3	TNH3	DNO2	TNO2	TP	DP	DPO4	TOC
		TFe	DFe	TAl	TPO4	TURB			
04/28/99	69	DO	TS	TOC					

Biological and Habitat Summary	
Number of Taxa	17
Diversity Index	3.28
RBP III Score	34
RBP III Condition	Slightly Impaired
Total Habitat Score	116
Habitat Condition Category	Excellent



Water Quality Index



Biological Index

adjusted concentrations for total chloride also showed a strong, significant increasing trend, and a significant increasing trend also occurred for flow-adjusted concentrations of total nitrogen. Significant decreasing trends were found for unadjusted total manganese and flow-adjusted total phosphorus concentrations, while strong, significant decreasing trends were found for unadjusted ammonia, total phosphorus, and total iron and in flow-adjusted concentrations of total manganese (Table 17).

River Sites

Susquehanna River at Windsor, N.Y.

Susquehanna River at Windsor, N.Y., (SUSQ 365.0) had a nonimpaired biological community during fiscal year 1999. For several years, this site had served as the reference site for the river stations. SUSQ 365.0 still contained several organic pollution-intolerant taxa, including *Atherix*, *Stenonema*, *Isonychia*, *Ephoron* (Ephemeroptera: Polymitarcyidae), *Acroneuria*, *Agnetina*, and *Paragnetina* (Plecoptera: Perlidae).

Water quality data showed that total iron exceeded the New York State standard in February 1999. Dissolved oxygen also was reduced and nitrates were elevated (Table 44) at this site. SUSQ 365.0 had the lowest average WQI score (41) and the lowest individual WQI score (30) of all sites in this category.

Several strong, significant decreasing trends occurred at SUSQ 365.0. These downward trends included both unadjusted and flow-adjusted concentrations of total ammonia, total phosphorus, and total iron. Strong, significant decreasing trends also occurred for unadjusted total nitrogen, and flow-adjusted total manganese and total aluminum. A significant decreasing trend also was found for unadjusted total manganese (Table 17).

Susquehanna River at Kirkwood, N.Y.

Nonimpaired conditions existed at Susquehanna River at Kirkwood, N.Y., (SUSQ 340.0). Previous impairments may have been due to the lack of suitable riffle habitat at this site. Habitat conditions were considered supporting, but were degraded due to the lack of riffles.

Total iron exceeded standards during the 1999 fiscal year. Additional water quality analysis indicated that solids were elevated during July 1998, while dissolved oxygen was depressed during July 1998 and May 1999 (Table 45).

Strong, significant downward trends occurred at SUSQ 340 for several parameters, including unadjusted and flow-adjusted concentrations of total ammonia, total nitrogen, total phosphorus, and total iron. Unadjusted total manganese also showed a significant downward trend (Table 17).

Susquehanna River at Sayre, Pa.

The Susquehanna River at Sayre, Pa., (SUSQ 289.1) served as the reference site for the Susquehanna, Chemung, Cowanesque, and Tioga River sites during fiscal year 1999. SUSQ 289.1 had the best available combination of macroinvertebrate community and physical habitat for the river sites. Several pollution-intolerant taxa inhabited this site including *Atherix*, *Serratella*, *Stenonema*, *Isonychia*, *Ephoron*, and *Agnetina*.

Total iron and pH exceeded standards during the 1999 fiscal year, and additional water quality analysis indicated that ammonia, and nitrates were elevated at this site, while dissolved oxygen was reduced (Table 46).

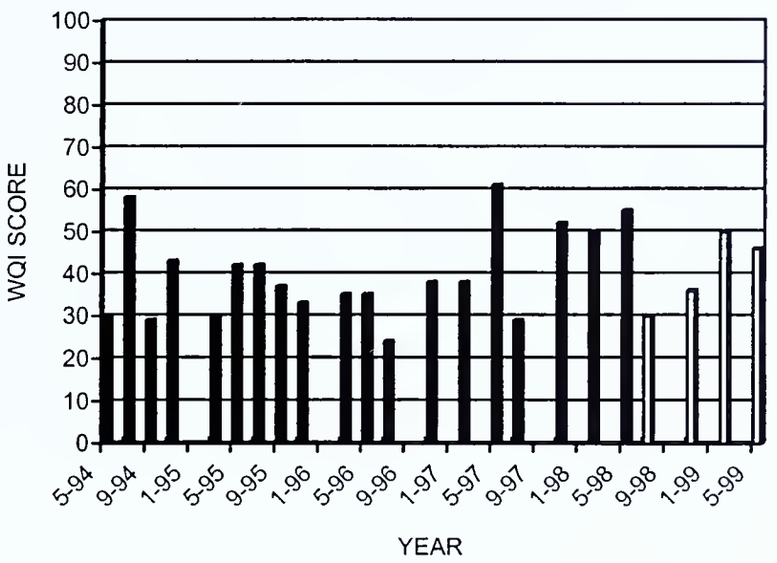
Strong, significant decreasing trends were found for several parameters at SUSQ 289.1, including both unadjusted and flow-adjusted concentrations of total nitrogen, total phosphorus, total iron, and total manganese, unadjusted total ammonia, and flow-adjusted total aluminum. A significant decreasing trend occurred for flow-adjusted concentrations of total solids and total ammonia and unadjusted total aluminum.

Table 44. Water Quality Summary Susquehanna River at Windsor, N.Y.

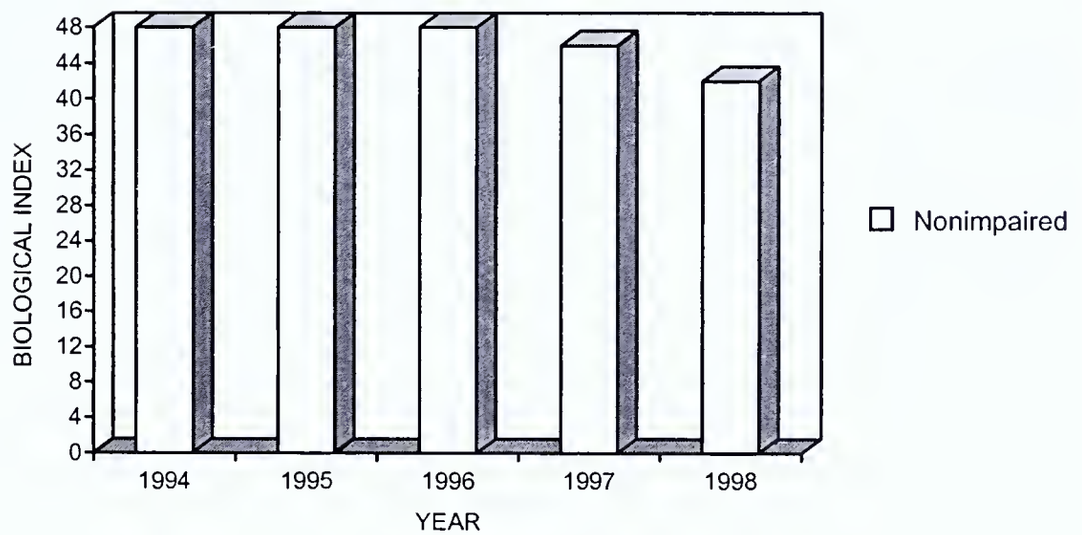
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
TFe	02/16/99	321 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
7/27/98	30	DO							
11/10/98	36	DO	DNO3						
2/16/99	50	DO							
5/12/99	46	DO	DFe						

Biological and Habitat Summary	
Number of Taxa	21
Diversity Index	3.27
RBP Score	42
RBP Condition	Nonimpaired
Total Habitat Score	125
Habitat Condition Category	Excellent



Water Quality Index



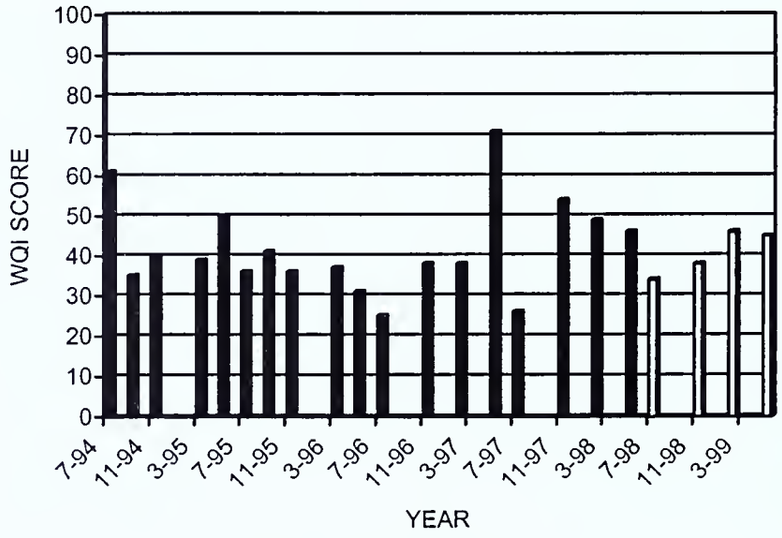
Biological Index

Table 45. Water Quality Summary Susquehanna River at Kirkwood, N.Y.

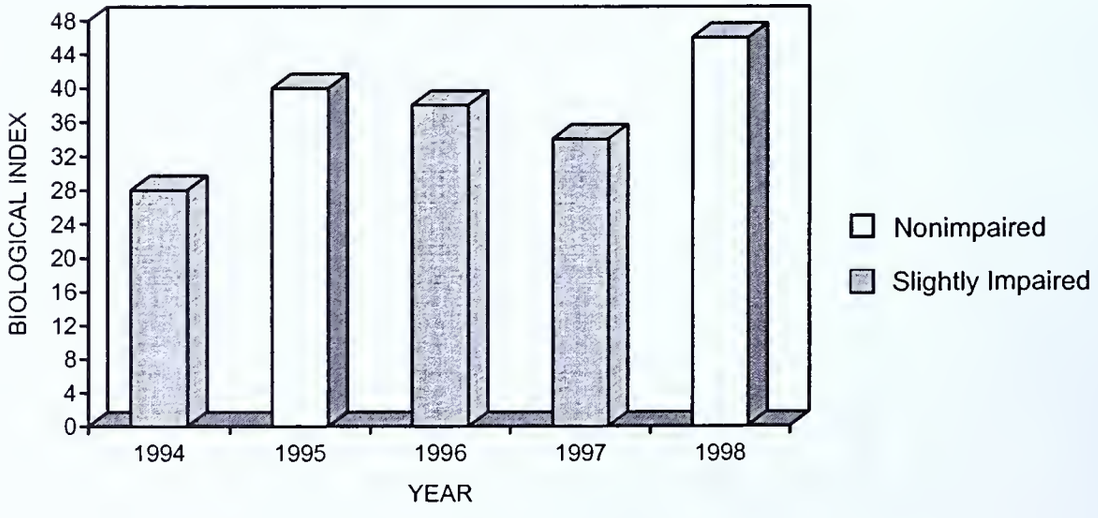
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
TFe	5/12/99	362 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
7/27/98	34	DO	TS	DS					
11/10/98	38	DFe							
2/16/99	46								
5/12/99	45	DO							

Biological and Habitat Summary	
Number of Taxa	23
Diversity Index	3.91
RBP Score	46
RBP Condition	Nonimpaired
Total Habitat Score	90
Habitat Condition Category	Supporting



Water Quality Index



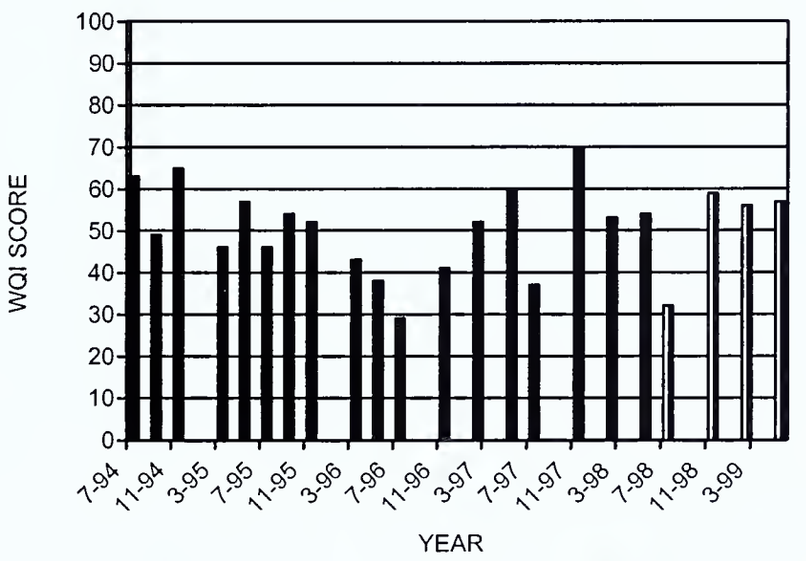
Biological Index

Table 46. Water Quality Summary Susquehanna River at Sayre, Pa.

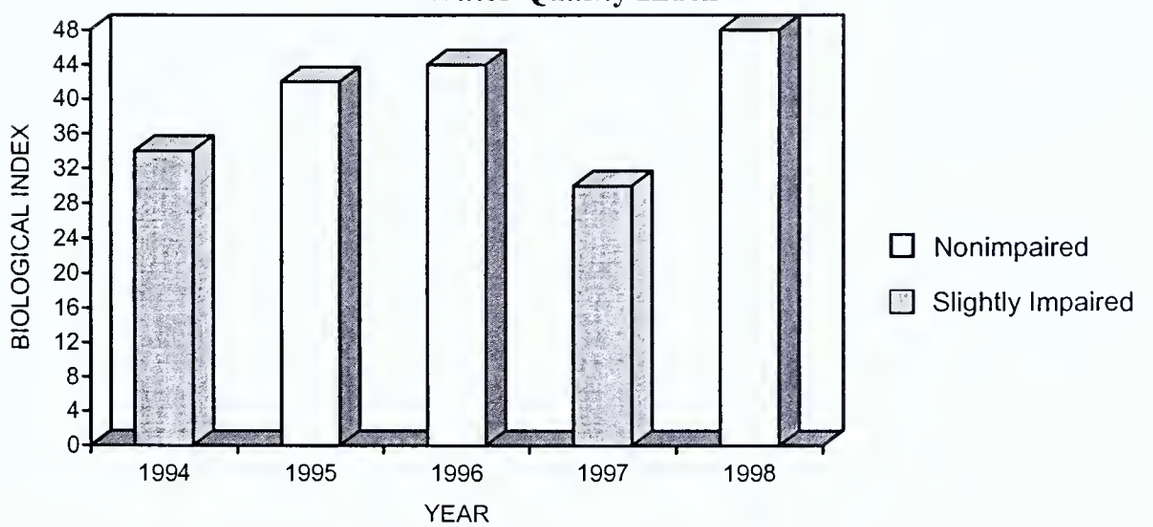
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
pH	7/28/99	8.55	6.5 – 8.5	N.Y. aquatic life
TFe	05/11/99	438 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
7/28/98	32								
11/10/98	59	DO	DNH3	TNH3	TNO2	DNO3	TNO3		
02/16/99	56	DO	DNH3	TNH3	TNO3				
05/11/99	57	DO	DNO2	TFe					

Biological and Habitat Summary	
Number of Taxa	19
Diversity Index	3.69
RBP Score	48
RBP Condition	Reference
Total Habitat Score	117
Habitat Condition Category	Reference



Water Quality Index



Biological Index

Significant increasing trends were found for unadjusted and flow-adjusted WQI, while strong, significant increasing trends occurred for unadjusted and flow-adjusted total chloride (Table 17).

Chemung River

A slightly impaired biological community existed in the Chemung River at Chemung, N.Y., (CHEM 12.0). During fiscal year 1998, a moderately impaired biological community was found at this site. The physical habitat was considered supporting.

Although no parameters exceeded standards at this site during fiscal year 1999, the water quality was poor. Analysis indicated that dissolved oxygen was depressed, while solids, calcium, magnesium, chloride, phosphorus, nitrites, and nitrates were elevated at CHEM 12.0 (Table 47).

Flow-adjusted total chloride showed a strong, significant increasing trend. All other parameters decreased over the period involved. Strong, significant decreasing trends were found for unadjusted and flow-adjusted total ammonia, total phosphorus, total sulfate, and total iron (Table 17).

Tioga River

The Tioga River at Lindley, N.Y., (TIOG 10.8) had a slightly impaired biological community during July 1998. However, habitat was considered excellent. Total iron exceeded water quality standards during February 1999. Additional water quality analysis indicated that sulfate and manganese were elevated, while dissolved oxygen and alkalinity were reduced (Table 48).

Poor water quality at this site may have been due to acid mine drainage in the headwaters of the Tioga River. The Tioga-Hammond Reservoir, located upstream of TIOG 10.8, alleviated some of the effects of acid mine drainage by buffering the outflow of Tioga Lake with alkaline waters stored in Hammond Lake. However, the effects of the acid mine drainage may still be observed downstream. Poor quality water from the Cowanesque River also may affect the Tioga River downstream of their confluence.

A strong, significant increasing trend occurred for flow-adjusted total aluminum, while a significant decreasing trend was found for unadjusted total phosphorus. Strong, significant decreasing trends were found for adjusted and unadjusted total ammonia and total sulfate and for flow-adjusted total chloride and total manganese (Table 17).

Cowanesque River

Severely impaired biological conditions existed on the Cowanesque River at Lawrenceville, Pa., (COWN 2.2). Moderately to severely impaired conditions have existed at this site for the past seven years of sampling. In the past, increased phyto-plankton production in the Cowanesque Reservoir may have caused a shift in the macroinvertebrate community, resulting in a biological population dominated by filter-feeding organisms. Additionally, the bottom discharge dam depressed oxygen levels in the Cowanesque River downstream of the outflow. Impaired conditions also may be affected by very poor habitat conditions at this site. The Cowanesque River also had very poor water quality at this site, which may affect the biological community. The site was heavily dominated by pollution-tolerant asellids. Of the sites in this category, COW 2.2 had the fewest number of taxa (7), the lowest diversity index (1.84), the highest Hilsenhoff Biotic Index (7.18), the lowest EPT index (3), and the lowest overall RBP III score (6).

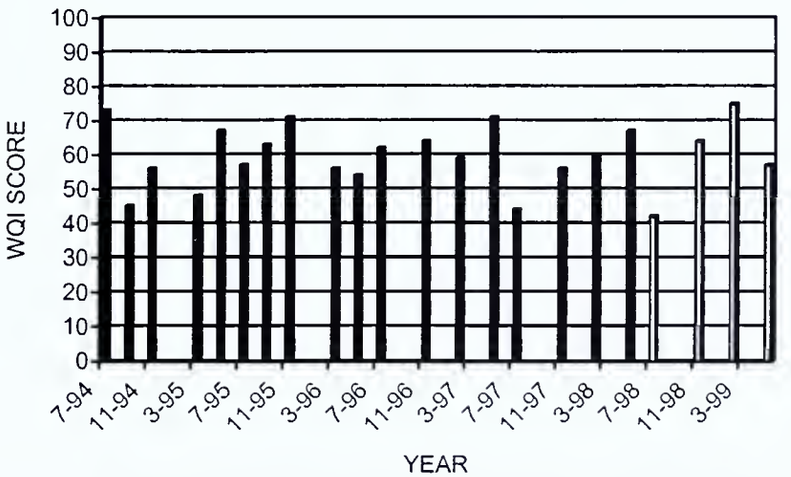
The Cowanesque River had the highest average WQI score (65) and the highest individual WQI score (84) of the river sites. Total iron concentrations exceeded New York State standards during all sampling periods. During July 1998, total manganese also exceeded the New York State standard. Water quality analysis indicated elevated concentrations of a variety of parameters, including nitrates, total organic carbon, iron, aluminum, manganese, and turbidity (Table 49).

Table 47. Water Quality Summary Chemung River at Chemung, N.Y.

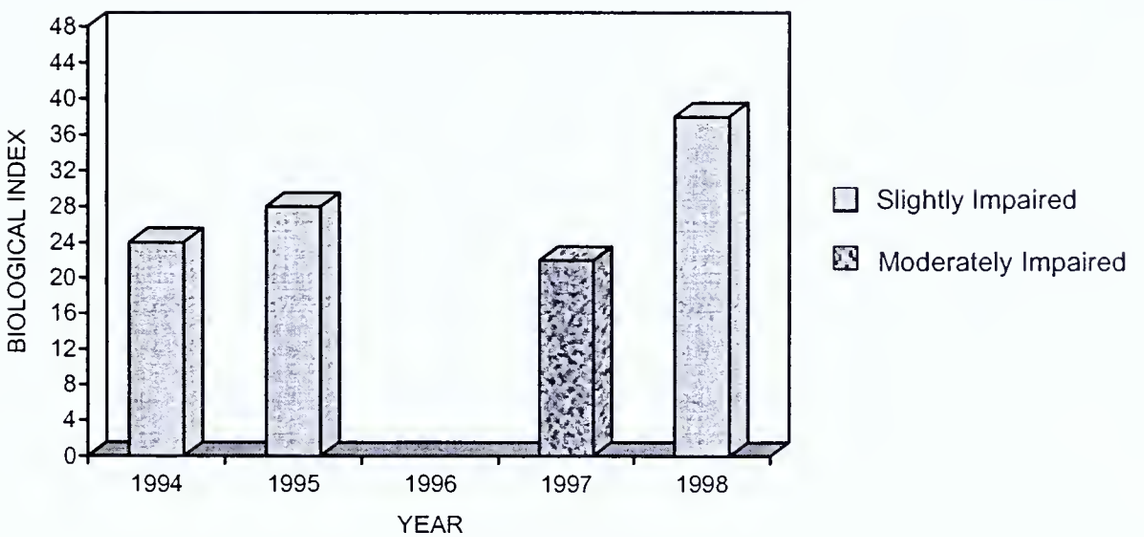
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
7/29/98	42	DO	COND	TCA	TMG	TCL			
11/11/98	64	DO	COND	TS	DS	DNO3	TNO3	TP	DP
		DPO4	TCA	TMG	TCL	TPO4			
02/17/99	75	DO	COND	DS	DNO2	DNO3	TNO3	TP	DP
		TCA	TMG	TCL	DFE				
05/11/99	57	DO	COND	TS	DS	DNO2	TOC	TCA	TMG
		TCL							

Biological and Habitat Summary	
Number of Taxa	19
Diversity Index	3.57
RBP Score	38
RBP Condition	Slightly Impaired
Total Habitat Score	106
Habitat Condition Category	Supporting



Water Quality Index



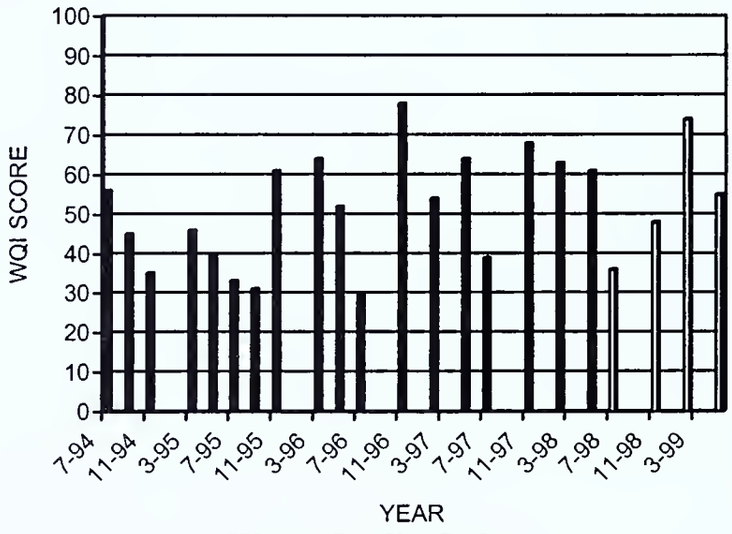
Biological Index

Table 48. Water Quality Summary Tioga River at Lindley, N.Y.

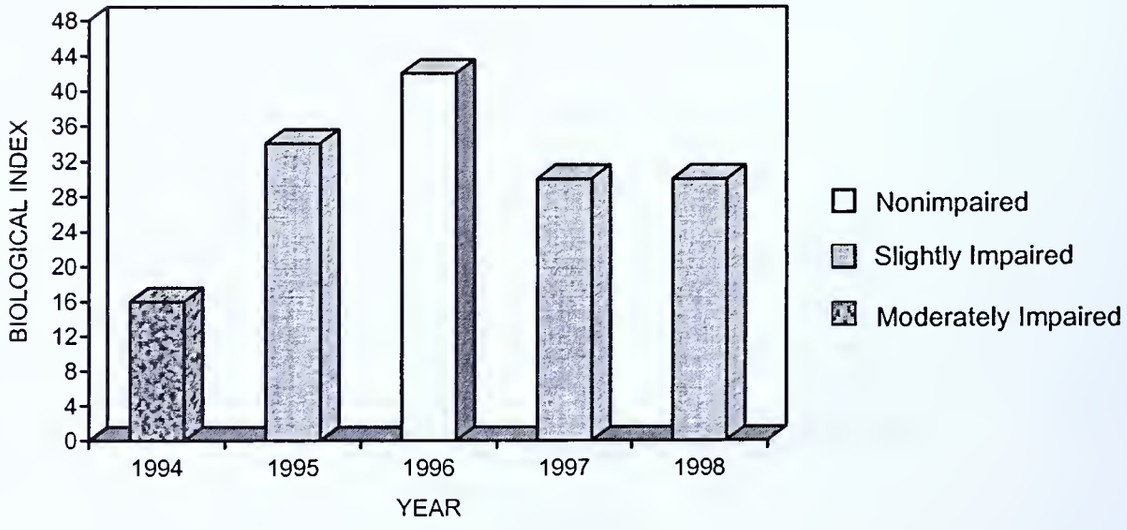
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	02/17/99	514 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/29/98	36	TSO4							
11/11/98	48	DO	ALK	TSO4	DMn				
02/17/99	74	DO	ALK	TSO4	TMn	DMn			
05/13/99	55	DO	ALK	TSO4	TMn	DMn			

Biological and Habitat Summary	
Number of Taxa	16
Diversity Index	3.31
RBP III Score	30
RBP III Condition	Slightly Impaired
Total Habitat Score	122
Habitat Condition Category	Excellent



Water Quality Index



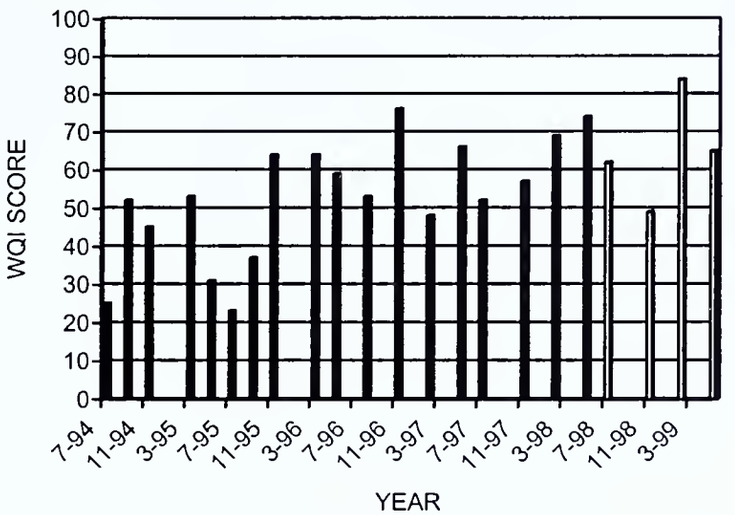
Biological Index

Table 49. Water Quality Summary Cowanesque River at Lawrenceville, Pa.

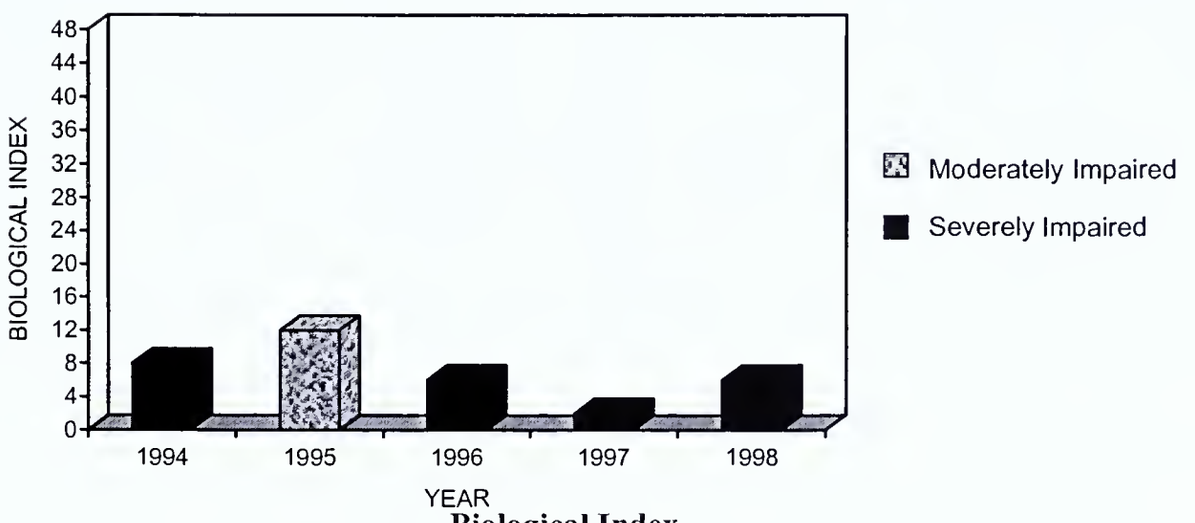
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
TFe	07/29/98	614 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	11/12/98	362 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	02/17/99	738 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	05/13/99	434 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TMn	07/29/98	941 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/29/98	62	TNH3	DNO2	TNO2	TOC	TMn	DMn	TAl	TURB
11/12/98	49	DO	TOC	TFe	TMn	DMn	TURB		
02/17/99	84	DO	TS	DS	TNH3	DNO2	TNO2	DNO3	TNO3
		TP	DP	DPO4	TOC	TFe	TAl	TPO4	
05/13/99	65	DNH3	TNO3	DNO2	TNO2	DNO3	TNO3	TOC	TFe
		TAl	TURB						

Biological and Habitat Summary	
Number of Taxa	7
Diversity Index	1.84
RBP Score	6
RBP Condition	Severely Impaired
Total Habitat Score	66
Habitat Condition Category	Nonsupporting



Water Quality Index



Biological Index

A mixture of upward and downward trends occurred in the Cowanesque River during 1986 through 1999. A strong, significant increasing trend was found for unadjusted WQI. A significant upward trend occurred for flow-adjusted WQI. Strong, significant decreasing trends occurred for unadjusted and flow-adjusted total sulfate and a significant downward trend was found for total solids (Table 17).

Susquehanna River at Marietta, Pa.

The Susquehanna River at Marietta, Pa., (SUSQ 44.5) had a nonimpaired biological community during fiscal year 1999. Habitat at this site was considered supporting; however, the substrate at SUSQ 44.5 is largely bedrock with little riffle habitat.

During August 1998, pH exceeded Maryland State standards, and total iron exceeded Pennsylvania State standards during April 1999. Additional water quality analysis indicated that sulfate, manganese, and iron were elevated at this station (Table 50).

Only decreasing trends were found at this site. Significant downward trends occurred for unadjusted total ammonia, total aluminum, and WQI. Strong, significant decreasing trends were found for flow-adjusted total ammonia, total sulfate, and WQI for unadjusted total manganese, and for both unadjusted and flow-adjusted total phosphorus and total iron (Table 17).

Susquehanna River at Conowingo, Md.

No macroinvertebrate sampling was performed in the Susquehanna River at Conowingo, Md., (SUSQ 10.0) due to deep waters and a lack of riffle habitat. Water quality did not exceed standards at SUSQ 10.0; however, analysis indicated that a variety of parameters, including solids, ammonia, calcium, and manganese were elevated at this site (Table 51). The Conowingo Dam impoundment, located directly upstream from the sampling site, may have affected the water quality at this site.

At SUSQ 10.0, only downward trends were observed. Significant decreasing trends were found for unadjusted ammonia and sulfate and for flow-adjusted nitrogen, iron, aluminum, manganese and phosphorus. Strong, significant downward trends occurred in unadjusted total phosphorus and total iron (Table 17).

MANAGEMENT IMPLICATIONS

To establish water quality trends and understand biological conditions, long-term studies of this nature are critical. Unfortunately, short-term monitoring studies are too often the rule, due to time and monetary constraints. However, to effectively manage the resources, federal, state, and local interest groups must have a true picture of ecological dynamics and possible problem areas, which can only be obtained through long-term studies such as this one.

Several management implications can be extracted from the chemical water quality, macroinvertebrate community, and physical habitat data collected from sampling areas. A Pearson Product Moment Correlation was performed for each reference category for average WQI score, RBP III score, and physical habitat score. Statistically significant relationships ($p<0.05$) observed among the chemical characteristics, the biological communities, and physical habitat of the interstate streams are described below. These observations, although based on a small sample size, are presented as possible subject areas for future research and as issues to be considered by aquatic resource managers, legislators, and local interest groups.

New York–Pennsylvania Sites

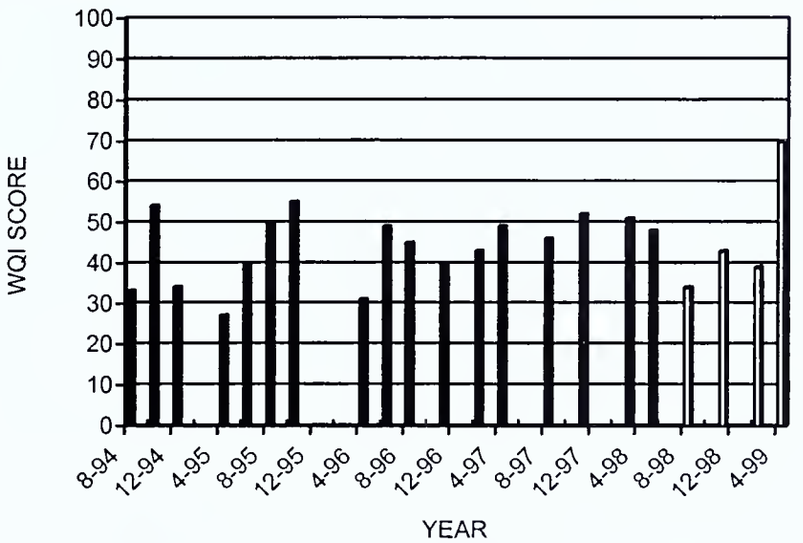
The New York-Pennsylvania border sites continued to show a large degree of variability in water quality. Overall, there was no significant correlation between RBP III score and water chemistry (WQI score) or between RBP III score and habitat score for the 14 New York-Pennsylvania border sites. During the 1998

Table 50. Water Quality Summary Susquehanna River at Marietta, Pa.

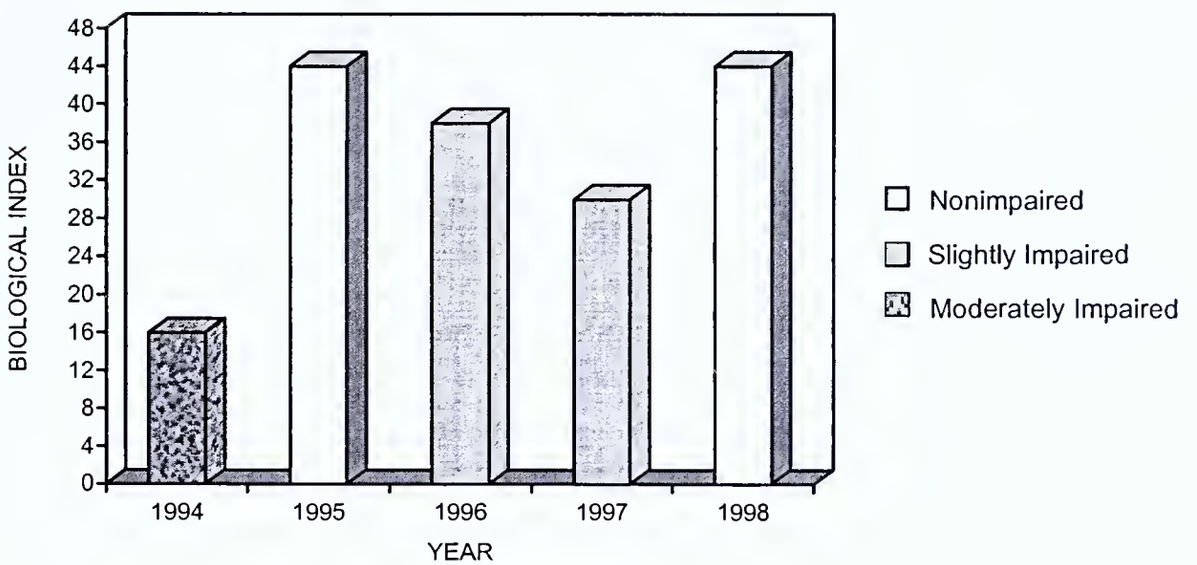
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
pH	08/06/98	9.0	6.5 – 8.5	Md. aquatic life
TFe	04/12/99	1,830 µg/l	1,500 µg/l	Pa. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
08/06/98	34	TOC	TMg	TSO4					
11/10/98	43	COND	TS	DS	TCa	TSO4			
02/25/99	39	DFe	DMn						
04/12/99	70	TS	DNH3	TNH3	TP	DP	DPO4	TFe	DFe
		TMn	TAl	TPO4					

Biological and Habitat Summary	
Number of Taxa	17
Diversity Index	3.48
RBP Score	44
RBP Condition	Nonimpaired
Total Habitat Score	101
Habitat Condition Category	Supporting



Water Quality Index

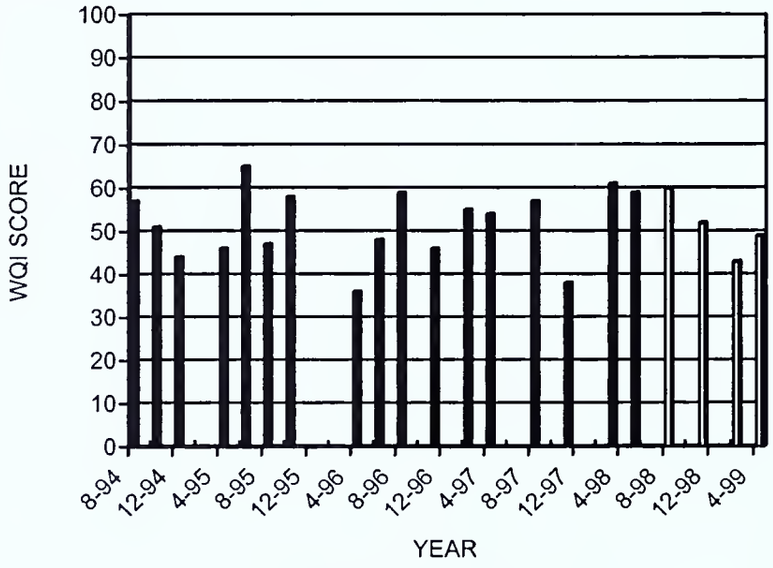


Biological Index

Table 51. Water Quality Summary Susquehanna River at Conowingo, Md.

Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/05/98	60	DO	TS	DS	DNH3	TNH3	DNO2	TNO2	TOC
		TMn	DMn	TURB					
11/05/98	52	COND	DNH3	TCa	TMg	TSO4			
02/10/99	43	TCa	TMn						
04/27/99	49	TCa	TSO4	DMn					



Water Quality Index

sampling season, there was a significant positive correlation ($p<0.05$) between habitat score and biological score. Although no significant correlation existed during the 1999 sampling season, impairment may have been due to poor physical habitat at many of the New York-Pennsylvania border sites. Bentley Creek and Seeley Creek, in particular, had unstable stream substrate, largely due to removal of instream habitat for rechannelization and the removal of gravel for building and paving materials. Disturbance of instream habitat often reduces the abundance of macroinvertebrates and the species diversity of the area, resulting in an impairment designation.

Pennsylvania–Maryland Sites

There was no significant correlation between physical habitat and biological score for the nine Pennsylvania-Maryland border sites. However, a significant negative correlation existed between the RBP III score and the water chemistry score. A positive WQI score denotes poor water quality, which indicates that a degradation in water quality leads to a degradation in the biological community.

The area surrounding the Pennsylvania-Maryland border sites is largely agricultural. Heavy agricultural activities without proper best management practices often result in streambank erosion and sedimentation, contributing to poor instream habitat quality and to nutrient enrichment. Additionally, nutrient enrichment encourages excessive plant growth, which can depress dissolved oxygen levels when vegetation decomposes.

River Sites

For the seven river sites, there was a significant negative correlation between average WQI and RBP III scores, indicating that as WQI increased, the quality of the macroinvertebrate community decreased. There was no significant correlation between the physical habitat and total biological scores for the river sites. Thus, it appears that water quality may be a limiting factor for the biological communities of the river sites.

CONCLUSIONS

Twelve (40 percent) of the 30 interstate macroinvertebrate sampling sites contained nonimpaired biological communities. Biological conditions at another 14 sites (46.7 percent) were slightly impaired, while two sites (6.7 percent) were moderately impaired. Two sites (6.7 percent), Scott Creek and Cowanesque River, were designated severely impaired. One site (SUSQ 10.0) was not sampled using RBP III techniques and, thus, was not averaged into the final scores. Nine sites (30 percent) had excellent habitat. Eleven of the sites (36.7 percent) had supporting habitat, and six sites (20 percent) had partially supporting habitat. Four sites (13.3 percent) had nonsupporting habitat: Bentley Creek, Cowanesque River, Scott Creek, and Seeley Creek.

Overall, interstate streams seemed to achieve their designated uses, and only 23 observations (1 percent) of water chemistry parameters exceeded state standards. Total iron exceeded standards most frequently. These findings corresponded with those in past reporting periods and indicated that elevated iron concentrations may have been a natural condition of the streams in the basin.

Of the New York-Pennsylvania border streams, the biological communities of seven (50 percent) of these streams were nonimpaired. Five sites (35.7 percent) in the New York-Pennsylvania reference category were slightly impaired, and two streams (14.3 percent) were moderately impaired. Two sites had excellent habitat (14.3 percent) and six sites (42.9 percent) had supporting habitat. Of the remaining sites, four (28.6 percent) had partially supporting habitat, and two sites (14.3 percent) had nonsupporting habitat. High metal concentrations, particularly total iron, appeared to be the largest source of water quality degradation in this region. Neither WQI and biological scores nor physical habitat and biological scores were correlated. Rechannelization of the streambed and removal of instream habitat may have resulted in poor conditions for macroinvertebrate

colonization in several streams, including Bentley Creek and Seeley Creek.

Nonimpaired biological conditions existed at one (11.1 percent) of the nine Pennsylvania-Maryland interstate streams. Of the remaining eight sites, seven sites (77.7 percent) were slightly impaired, while one site (11.1 percent) was designated severely impaired. Four (44.4 percent) of the Pennsylvania-Maryland border sites had excellent habitat. Two sites (22.2 percent) had supporting habitat, two sites (22.2 percent) had partially supporting habitat, and one site (11.1 percent) had a nonsupporting habitat. Elevated nutrient levels, possibly due to agricultural runoff, appeared to affect the water quality of the streams in this region. WQI and RBP III scores were negatively correlated for the Pennsylvania-Maryland border sties. Streambank erosion and sedimentation impacted the instream habitat at sites in this region.

River sites consisted of eight stations located on the Susquehanna River, Chemung River, Cowanesque River, and Tioga River. One station (SUSQ 10.0) was not sampled for macroinvertebrates due to a lack of riffle habitat at the site. The biological communities of four sites (57.1 percent) were nonimpaired, two sites (28.6 percent) were slightly impaired, and one site (14.3 percent) was severely impaired. Three of the sites (42.9 percent) had excellent habitat. Of the remaining four sites, three sites (42.9 percent) had supporting habitat, and one site (14.3 percent) had nonsupporting habitat. WQI and RBP III scores were significantly correlated for the river sites, indicating that, as WQI increased, the quality of the macroinvertebrate community decreased.

The Seasonal Kendall nonparametric test for trend was applied to observed concentration and flow-adjusted concentration. Trends were detected ($p<0.10$) for several parameters at individual stations. For each parameter, an overall weighted value was calculated to indicate the strength of the trend in the Susquehanna River Basin over the period 1986 through 1999. Table 52 provides a summary of detected trends and overall direction.

Significant overall weighted trends were found in total ammonia, total phosphorus, total iron, and total manganese. Decreasing trends in total iron were found at many of the river stations. Most trends detected were decreasing, indicating an improvement in water quality. However, increasing trends, including total chlorides and total nitrogen, were detected at several sites, mostly along the Pennsylvania-Maryland border.

The current and historical data contained in this report provide a database that enables SRBC staff and others to better manage water quality, water quantity, and biological resources of interstate streams in the Susquehanna River Basin. The data can be used by SRBC's member states and local interest groups to gain a better understanding of water quality in upstream and downstream areas outside of their jurisdiction. Information in this report also can serve as a starting point for more detailed assessments and remediation efforts that may be planned on these streams.

Table 52. Summary of Overall Direction of Trends

Parameter	Detected Trends				Overall Direction of Concentration Trend	Overall Direction of Flow-Adjusted Concentration Trend
	Concentration		Flow-Adjusted Concentration			
	+	-	+	-		
Total Suspended Solids	1	2	1	2	None	None
Total Ammonia	0	11	0	7	Decreasing	None
Total Nitrogen	4	3	4	4	None	None
Total Phosphorus	0	13	0	12	Decreasing	Decreasing
Total Chloride	5	0	6	1	None	None
Total Sulfate	1	7	0	7	None	None
Total Iron	0	12	0	10	Decreasing	Decreasing
Total Aluminum	0	3	1	4	None	None
Total Manganese	0	9	0	8	Decreasing	Decreasing
Water Quality Index	3	4	3	2	None	None

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Appendix A

Water Quality Data for Interstate Streams Crossing the New York-Pennsylvania and Pennsylvania-Maryland Borders

Table A1. Water Quality Data for New York-Pennsylvania Border Streams

Parameter	Units	APAL 6.9	BNTY 0.9	CASC 1.6	CAYT 1.7	CAYT 1.7	CAYT 1.7	CAYT 1.7
Date	yyyymmdd	19980728	19980729	19980727	19980729	19981111	19990216	19990512
Time	hhmm	1330	1215	1300	910	900	1515	1425
Discharge	cfs	1.812	3.748	0.686	32.417	25.446	109.09	6.71
Temp	degree C	21.9	21.1	20.7	20.9	5.8	3	15.8
Conductance	umhos/cm	98	317	74	361	402	169	275
Dissolved Oxygen	mg/l	6.67	8.19	5.86	8.69	7.37	7.76	6.58
pH		7	7.85	7	7.9	7.55	7	8.3
Alkalinity	mg/l	34	84	28	120	138	48	84
Acidity	mg/l	4	4	6	4	10	8	0
Solids, Total	mg/l	72	136		146	243	140	162
Solids, Dissolved	mg/l	50	126		124	243	140	46
Ammonia, Total	mg/l	0.07	0.09	0.03	0.05	<0.02	<0.02	<0.02
Ammonia, Dissolved	mg/l	0.04	<0.02	<0.02	0.04	<0.02	<0.02	<0.02
Nitrite, Total	mg/l	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Nitrite, Dissolved	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate, Total	mg/l	0.21	0.12	0.05	0.61	0.97	0.53	0.54
Nitrate, Dissolved	mg/l	0.2	0.11	<0.04	0.61	0.97	0.53	0.54
Phosphorus, Total	mg/l	<0.02	<0.02	0.02	0.02	0.12	0.04	0.09
Phosphorus, Dissolved	mg/l	0.012	0.008	0.011	0.015	0.1	0.024	0.081
Orthophosphate, Total	mg/l	0.012	0.004	0.01	0.023	0.098	0.023	0.097
Orthophosphate, Dissolved	mg/l	0.012	0.004	0.007	0.015	0.109	0.008	0.064
Organic Carbon, Total	mg/l	2.3	2.3	3	2.6	1.8	2.2	2.9
Calcium	mg/l	9.7	26.8	8.45	38.4	46	16.4	29.6
Magnesium	mg/l	2.96	5.09	2.21	7.72	9.26	3.65	5.97
Chloride	mg/l	6	10	2	33	37	17	28
Sulfate	mg/l	<10	12	<10	15	16	<10	<10
Turbidity	ntu	4.6	<1	2.6	<1	<1	5.02	<1
Iron, Total	µg/l	495	84	1050	38	40	206	105
Iron, Dissolved	µg/l	134	13	432	<20	<20	27	81
Manganese, Total	µg/l	115	<10	185	15	<10	13	20
Manganese, Dissolved	µg/l	98	<10	134	15	<10	<10	17
Aluminum, Total	µg/l	<200	<200	<200	<200	<200	<200	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A1. Water Quality Data for New York-Pennsylvania Border Streams —Continued

Parameter	Units	CHEM 12.0	CHEM 12.0	CHEM 12.0	CHEM 12.0	CHOC 9.1	COWN 2.2	COWN 2.2
Date	yyyymmdd	19980729	19981111	19990217	19990511	19980728	19980729	19981112
Time	hhmm	1030	1050	830	1130	1145	1800	805
Discharge	cfs	595	290	2,890	1,885	3.227	30	18
Temp	degree C	23.7	7.7	3.3	16.8	21.1	19.8	9.8
Conductance	umhos/cm	412	469	234	292	98	171	222
Dissolved Oxygen	mg/l	6.36	6.84	7.58	5.76	7.67	7.6	6.99
pH		8.2	7.9	7.15	8.05	7	7.2	7.8
Alkalinity	mg/l	116	140	62	85	28	56	66
Acidity	mg/l	2	6	6	6	6	4	6
Solids, Total	mg/l	230	310	110	176		122	160
Solids, Dissolved	mg/l	220	300	132	164		122	142
Ammonia, Total	mg/l	0.04	0.03	0.06	<0.02	0.07	0.17	0.05
Ammonia, Dissolved	mg/l	<0.02	<0.02	0.06	<0.02	0.07	0.15	0.02
Nitrite, Total	mg/l	<0.01	0.01	0.01	0.01	<0.01	0.03	0.01
Nitrite, Dissolved	mg/l	<0.01	0.01	0.01	0.01	<0.01	0.02	<0.01
Nitrate, Total	mg/l	0.36	0.95	0.86	0.4	0.18	0.49	0.31
Nitrate, Dissolved	mg/l	0.36	0.95	0.8	0.38	0.17	0.47	0.31
Phosphorus, Total	mg/l	<0.02	0.12	0.05	0.04	<0.02	0.03	0.03
Phosphorus, Dissolved	mg/l	0.01	0.101	0.031	0.026	0.009	0.012	0.012
Orthophosphate, Total	mg/l	0.012	0.118	0.031	0.016	0.01	0.024	0.002
Orthophosphate, Dissolved	mg/l	0.011	0.098	0.012	0.015	0.01	0.013	<0.002
Organic Carbon, Total	mg/l	3.5	2.5	2.6	3.2	2.3	6.2	3.9
Calcium	mg/l	39.7	54.9	23.3	35.9	8.95	19	28
Magnesium	mg/l	8.88	15	5.31	7.26	2.92	4:04	5.09
Chloride	mg/l	47	50	25	29	8	8	17
Sulfate	mg/l	21	21	22	<10	11	14	17
Turbidity	ntu	2.2	1.48	8.84	2.07	2.2	12.3	11.1
Iron, Total	µg/l	112	66	274	190	210	614	362
Iron, Dissolved	µg/l	15	<20	101	41	60	62	<20
Manganese, Total	µg/l	23	<10	63	65	60	941	190
Manganese, Dissolved	µg/l	<10	<10	50	19	47	797	51
Aluminum, Total	µg/l	<200	<200	<200	<200	<200	417	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A1. Water Quality Data for New York-Pennsylvania Border Streams —Continued

Parameter	Units	COWN 2.2	COWN 2.2	HLDN 3.5	LSNK 7.6	NFCR 7.6	SEEL 10.3	SNAK 2.3
Date	yyyymmdd	19990217	19990513	19980730	19980728	19980730	19980729	19980728
Time	hhmm	1205	1245	935	1015	1230	1530	900
Discharge	cfs	427	55		1.314		6.276	11.228
Temp	degree C	3.2	9.3	17.6	20.8	17.8	21.2	19.6
Conductance	umhos/cm	183	133	276	134	164	289	105
Dissolved Oxygen	mg/l	7.74	6.51	7.61	7.95	8.49	7.7	5.8
pH		6.85	6.9	7.4	7.15	7.6	7.45	7.15
Alkalinity	mg/l	52	38	114	38	54	118	32
Acidity	mg/l	8	8	6	4	2	6	8
Solids, Total	mg/l	160	104	140	128	128	176	76
Solids, Dissolved	mg/l	132	24	140	112	124	168	76
Ammonia, Total	mg/l	0.08	0.05	0.03	0.04	0.04	0.05	0.02
Ammonia, Dissolved	mg/l	0.07	0.04	0.02	0.04	0.04	0.05	0.02
Nitrite, Total	mg/l	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite, Dissolved	mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate, Total	mg/l	0.83	0.7	0.13	0.13	1.08	0.17	0.36
Nitrate, Dissolved	mg/l	0.75	0.7	0.13	0.08	1.03	0.17	0.36
Phosphorus, Total	mg/l	0.05	0.03	0.02	0.02	0.07	<0.02	<0.02
Phosphorus, Dissolved	mg/l	0.029	0.016	0.017	0.011	0.034	0.012	0.011
Orthophosphate, Total	mg/l	0.04	0.029	0.015	0.012	0.073	0.006	0.011
Orthophosphate, Dissolved	mg/l	0.02	0.005	0.014	0.012	0.035	0.006	0.008
Organic Carbon, Total	mg/l	3.5	3.2	3.5	4.4	4.4	1.5	2.5
Calcium	mg/l	21.1	13.8	33.3	9.87	16.7	40.4	8.38
Magnesium	mg/l	3.77	3.24	9.38	2.86	5.36	6.15	2.66
Chloride	mg/l	16	10	8	17	8	10	8
Sulfate	mg/l	20	<10	16	<10	<10	13	12
Turbidity	ntu	19.5	4.89	1.38	4	5.6	<1	1.33
Iron, Total	µg/l	738	434	51	966	470	23	42
Iron, Dissolved	µg/l	51	74	<20	544	48	<20	24
Manganese, Total	µg/l	95	137	25	170	61	<10	13
Manganese, Dissolved	µg/l	76	87	25	120	<10	<10	11
Aluminum, Total	µg/l	869	376	<200	<200	325	<200	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A1. Water Quality Data for New York-Pennsylvania Border Streams —Continued

Parameter	Units	SOUT 7.8	SUSQ 365.0	SUSQ 365.0	SUSQ 365.0	SUSQ 365.0	SUSQ 340.0	SUSQ 340.0
Date	yyyymmdd	19980729	19980727	19981110	19990216	19990512	19980727	19981110
Time	hhmm	1400	1100	1115	1120	1255	1500	1020
Discharge	cfs	0.742	892.4	202		1448	1,060	350
Temp	degree C	24	21.5	5.7	1.3	15.1	24.5	4.9
Conductance	umhos/cm	173	190	250	159	183	180	237
Dissolved Oxygen	mg/l	7.93	5.77	7.33	8.17	5.53	6.19	7.62
pH		7.65	7.8	7.5	6.85	7.55	8.1	7.45
Alkalinity	mg/l	62	70	92	54	62	58	84
Acidity	mg/l	4	4	6	6	6	2	6
Solids, Total	mg/l	80	122	174	72	140	258	172
Solids, Dissolved	mg/l	62	116	170	64	88	252	140
Ammonia, Total	mg/l	0.13	0.03	<0.02	0.03	<0.02	0.04	<0.02
Ammonia, Dissolved	mg/l	0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02
Nitrite, Total	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Nitrite, Dissolved	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Nitrate, Total	mg/l	0.06	0.46	0.92	0.68	0.57	0.29	0.35
Nitrate, Dissolved	mg/l	0.06	0.43	0.57	0.67	0.57	0.28	0.34
Phosphorus, Total	mg/l	<0.02	0.02	0.03	0.03	0.03	<0.02	0.03
Phosphorus, Dissolved	mg/l	0.011	0.011	0.02	0.02	0.016	0.01	0.014
Orthophosphate, Total	mg/l	0.008	0.011	<0.002	0.019	0.015	0.01	0.006
Orthophosphate, Dissolved	mg/l	0.008	0.011	<0.002	0.013	0.005	0.01	0.006
Organic Carbon, Total	mg/l	4.9	3.2	2.1	2.3	2.5	3.1	2.6
Calcium	mg/l	18.4	29.2	42.3	20.4	25	24.4	39.5
Magnesium	mg/l	3.59	3.14	4.43	2.35	3.12	2.85	4.27
Chloride	mg/l	11	12	16	13	13	11	17
Sulfate	mg/l	<10	<10	12	<10	<10	<10	15
Turbidity	ntu	1.99	1.95	1.1	9.19	<1	2.9	2.2
Iron, Total	µg/l	160	145	139	321	189	176	212
Iron, Dissolved	µg/l	43	21	29	47	133	28	72
Manganese, Total	µg/l	42	27	14	22	38	37	48
Manganese, Dissolved	µg/l	27	<10	<10	14	16	12	13
Aluminum, Total	µg/l	<200	<200	<200	<200	<200	<200	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A1. Water Quality Data for New York-Pennsylvania Border Streams —Continued

Parameter	Units	SUSQ 340.0	SUSQ 340.0	SUSQ 289.1	SUSQ 289.1	SUSQ 289.1	SUSQ 289.1	TIOG 10.8
Date	yyyymmdd	19990216	19990512	19980728	19981110	19990216	19990511	19980729
Time	hhmm	1005	1145	1645	1305	1325	1230	1700
Discharge	cfs	4,155	1,800	2,310	823	10,050	5,330	114.6
Temp	degree C	1.4	16.6	25.4	6.1	2.5	17.2	24.5
Conductance	umhos/cm	140	173	267	343	171	225	189
Dissolved Oxygen	mg/l	8.56	5.93	9.23	7.22	7.85	5.63	7.93
pH		6.9	7.6	8.55	7.6	7	8.1	7.6
Alkalinity	mg/l	46	58	88	110	54	70	56
Acidity	mg/l	6	6	0	6	4	6	4
Solids, Total	mg/l	<2	124	138	252	60	152	134
Solids, Dissolved	mg/l	<2	100	128	242	60	124	134
Ammonia, Total	mg/l	0.03	0.03	0.03	0.09	0.08	<0.02	0.03
Ammonia, Dissolved	mg/l	0.03	<0.02	0.03	0.09	0.08	<0.02	0.03
Nitrite, Total	mg/l	<0.01	<0.01	<0.01	0.03	<0.01	0.01	<0.01
Nitrite, Dissolved	mg/l	<0.01	<0.01	<0.01	0.03	<0.01	0.01	<0.01
Nitrate, Total	mg/l	0.65	0.4	0.43	0.95	0.77	0.54	0.47
Nitrate, Dissolved	mg/l	0.65	0.38	0.43	0.9	0.76	0.49	0.45
Phosphorus, Total	mg/l	0.04	0.04	<0.02	0.06	0.04	0.06	0.02
Phosphorus, Dissolved	mg/l	0.019	0.016	0.009	0.053	0.021	0.02	0.015
Orthophosphate, Total	mg/l	0.025	0.023	0.011	0.029	0.018	0.025	0.012
Orthophosphate, Dissolved	mg/l	0.016	0.006	0.007	0.026	0.012	0.007	0.009
Organic Carbon, Total	mg/l	2.2	2.6	3	2.5	2.3	2.9	3.8
Calcium	mg/l	16.5	22.2	33.7	47.9	18.8	29.7	21.3
Magnesium	mg/l	2.26	2.89	5.32	6.95	2.93	4.6	4.82
Chloride	mg/l	12	15	23	34	17	22	8
Sulfate	mg/l	<10	<10	11	13	<10	<10	28
Turbidity	ntu	6.41	1.06	2.8	<1	8.64	3.07	4.2
Iron, Total	µg/l	235	362	168	66	279	438	224
Iron, Dissolved	µg/l	45	48	<20	<20	33	26	25
Manganese, Total	µg/l	21	53	31	12	19	54	109
Manganese, Dissolved	µg/l	13	21	12	<10	12	10	75
Aluminum, Total	µg/l	<200	<200	<200	<200	<200	285	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A1. Water Quality Data for New York-Pennsylvania Border Streams —Continued

Parameter	Units	TIOG 10.8	TIOG 10.8	TIOG 10.8	TROW 1.8	TRUP 4.5	TRUP 4.5	TRUP 4.5
Date	yyyymmdd	19981111	19990217	19990513	19980727	19980730	19981112	19990217
Time	hhmm	1220	1005	1045	1630	1100	1015	1425
Discharge	cfs	93.47	945.4	255.4	0.993	3.206	2.837	25.15
Temp	degree C	8.2	3	12	22.5	19.1	7.3	2.8
Conductance	umhos/cm	243	163	149	74	297	316	143
Dissolved Oxygen	mg/l	6.93	7.9	5.58	6.19	8.17	6.68	8.08
pH		7.2	6.8	6.85	7.25	8.3	7.6	6.95
Alkalinity	mg/l	48	38	32	22	118	114	36
Acidity	mg/l	4	10	8	2	0	10	6
Solids, Total	mg/l	190	112	108	50		214	60
Solids, Dissolved	mg/l	176	112	78	40		208	28
Ammonia, Total	mg/l	0.03	0.07	<0.02	<0.02	0.18	<0.02	0.04
Ammonia, Dissolved	mg/l	0.03	0.07	<0.02	<0.02	0.02	<0.02	<0.02
Nitrite, Total	mg/l	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.02
Nitrite, Dissolved	mg/l	<0.01	<0.004	<0.01	<0.01	<0.01	<0.01	<0.004
Nitrate, Total	mg/l	0.52	0.67	0.34	0.17	<0.04	0.07	0.72
Nitrate, Dissolved	mg/l	0.47	0.66	0.32	0.17	<0.04	<0.04	0.69
Phosphorus, Total	mg/l	0.03	0.04	0.03	<0.02	<0.02	0.02	0.04
Phosphorus, Dissolved	mg/l	0.023	0.022	0.021	0.013	0.012	0.003	0.024
Orthophosphate, Total	mg/l	0.007	0.03	0.027	0.012	0.012	<0.002	0.041
Orthophosphate, Dissolved	mg/l	0.002	0.011	0.01	0.008	0.012	<0.002	0.012
Organic Carbon, Total	mg/l	2.6	3.1	2.6	2	3.1	2.2	3
Calcium	mg/l	31.6	16	15.6	6.21	34.9	46.8	16.7
Magnesium	mg/l	6.8	3.9	4.09	1.93	7.47	8.68	3.54
Chloride	mg/l	12	13	9	4	14	19	12
Sulfate	mg/l	40	25	26	<10	16	25	20
Turbidity	ntu	4.7	15.2	2.07	<1	1.79	<1	29.7
Iron, Total	µg/l	223	514	279	43	56	83	920
Iron, Dissolved	µg/l	<20	49	111	24	<20	<20	46
Manganese, Total	µg/l	94	261	218	<10	<10	17	20
Manganese, Dissolved	µg/l	52	218	185	<10	<10	15	<10
Aluminum, Total	µg/l	<200	473	247	<200	<200	<200	911
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A1. Water Quality Data for New York-Pennsylvania Border Streams —Continued

Parameter	Units	TRUP 4.5	WAPP 2.6
Date	yyyymmdd	19990513	19980728
Time	hhmm	1400	1500
Discharge	cfs	11.37	4.884
Temp	degree C	12.3	25.6
Conductance	umhos/cm	198	126
Dissolved Oxygen	mg/l	6.27	7.82
pH		7.7	7.5
Alkalinity	mg/l	78	36
Acidity	mg/l	6	4
Solids, Total	mg/l	138	84
Solids, Dissolved	mg/l		48
Ammonia, Total	mg/l	<0.02	0.12
Ammonia, Dissolved	mg/l	<0.02	0.05
Nitrite, Total	mg/l	<0.01	<0.01
Nitrite, Dissolved	mg/l	<0.01	<0.01
Nitrate, Total	mg/l	0.33	0.84
Nitrate, Dissolved	mg/l	0.33	0.82
Phosphorus, Total	mg/l	0.02	<0.02
Phosphorus, Dissolved	mg/l	0.009	0.01
Orthophosphate, Total	mg/l	0.009	0.009
Orthophosphate, Dissolved	mg/l	0.004	0.008
Organic Carbon, Total	mg/l	3.4	2.4
Calcium	mg/l	26	11.3
Magnesium	mg/l	4.72	3.6
Chloride	mg/l	12	7
Sulfate	mg/l	<10	12
Turbidity	ntu	1.06	1.2
Iron, Total	µg/l	90	105
Iron, Dissolved	µg/l	32	<20
Manganese, Total	µg/l	<10	19
Manganese, Dissolved	µg/l	<10	17
Aluminum, Total	µg/l	<200	<200
Aluminum, Dissolved	µg/l	<200	<200

Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams

Parameter	Units	BBDC 4.1	CNWG 4.4	CNWG 4.4	CNWG 4.4	CNWG 4.4	DEER 44.2	DEER 44.2
Date	yyyymmdd	19980804	19980806	19981106	19990211	19990428	19980804	19981105
Time	hhmm	1200	1120	1110	1030	1020	850	805
Discharge	cfs	2.07	18.139	20.26	18.3	25.51	8.154	7.19
Temp	degree C	16	22.3	6.4	4.3	12.1	17.7	3.9
Conductance	umhos/cm	123	221	222	229	216	180	176
Dissolved Oxygen	mg/l	8.64	7.32	6.83	7.41	5.96	8.45	7.97
pH		6.9	7.2	6.85	6.85	7.1	7.3	6.9
Alkalinity	mg/l	14	32	32	32	36	34	34
Acidity	mg/l	4	6	10	8	8	4	8
Solids, Total	mg/l		180	120	224	200	151	136
Solids, Dissolved	mg/l		160	120	292	200	145	130
Ammonia, Total	mg/l	0.03	0.08	0.14	0.03	0.04	0.19	0.05
Ammonia, Dissolved	mg/l	0.03	0.08	0.02	0.03	0.04	0.05	0.03
Nitrite, Total	mg/l	<0.01	0.03	0.01	0.02	0.06	<0.01	<0.01
Nitrite, Dissolved	mg/l	<0.01	0.02	0.01	0.02	0.06	<0.01	<0.01
Nitrate, Total	mg/l	5.65	9.72	9.89	8.81	8.24	5.21	4.93
Nitrate, Dissolved	mg/l	5.63	8.76	9.45	8.6	8.11	5.02	4.91
Phosphorus, Total	mg/l		0.04	0.03	0.06	0.05		0.02
Phosphorus, Dissolved	mg/l	0.012	0.027	0.024	0.035	0.026	0.002	0.018
Orthophosphate, Total	mg/l	0.012	0.029	0.016	0.056	0.02	0.013	0.015
Orthophosphate, Dissolved	mg/l	0.012	0.027	0.016	0.018	0.005	0.008	0.014
Organic Carbon, Total	mg/l	1.4	2.4	1.8	2.6	2.7	1.7	1.4
Calcium	mg/l	8.29	16.7	18.2	18.3	17.7	15.2	16.4
Magnesium	mg/l	5.15	9.68	9.82	12.4	11.4	6.05	6.04
Chloride	mg/l	11	18	17	21	18	20	21
Sulfate	mg/l	<10	12		<20	<20	<10	<10
Turbidity	ntu	2.6	4.5	<1	4.51	3.85	2.1	<1
Iron, Total	µg/l	140	265	118	238	195	123	134
Iron, Dissolved	µg/l	20	31	118		80	30	46
Manganese, Total	µg/l	15	36	18	40	70	16	40
Manganese, Dissolved	µg/l	<10	16	18	35	61	14	29
Aluminum, Total	µg/l	<200	<200	<200	<200	<200	<200	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams—Continued

Parameter	Units	DEER 44.2	DEER 44.2	EBAU 1.5	EBAU 1.5	EBAU 1.5	EBAU 1.5	FBDC 4.1
Date	yyyymmdd	19990210	19990427	19980804	19981105	19990210	19990427	19980804
Time	hhmm	810	845	1045	945	930	1020	1400
Discharge	cfs	22.35	22.58	4.434	4.936	6.67	5.2	1.485
Temp	degree C	3.2	10	16.9	4.8	3	9.5	16.8
Conductance	umhos/cm	221	182	736	242	166	163	105
Dissolved Oxygen	mg/l	7.99	6.32	8.52	7.71	7.42	6.58	8.12
pH		6.9	7.2	7.15	6.75	6.9	6.95	6.55
Alkalinity	mg/l	28	32	26	24	20	26	14
Acidity	mg/l	10	8	4	6	6	4	4
Solids, Total	mg/l	168	100		166	200	70	98
Solids, Dissolved	mg/l	136	50		166	180	70	96
Ammonia, Total	mg/l	<0.02	<0.02	0.16	0.13	<0.02	<0.02	0.09
Ammonia, Dissolved	mg/l	<0.02	<0.02	0.16	0.07	<0.02	<0.02	0.09
Nitrite, Total	mg/l	<0.01	0.02	<0.01	0.068	<0.01	0.02	<0.01
Nitrite, Dissolved	mg/l	<0.01	0.02	<0.01	0.06	<0.01	0.02	<0.01
Nitrate, Total	mg/l	4.59	4.44	6.33	7.81	5.93	5.31	4.74
Nitrate, Dissolved	mg/l	4.51	4.28	6.27	7.19	5.69	5.26	4.65
Phosphorus, Total	mg/l	0.02	0.02		0.088	0.03	0.05	
Phosphorus, Dissolved	mg/l	0.018	0.02	0.019	0.04	0.027	0.042	0.01
Orthophosphate, Total	mg/l	0.012	0.006	0.023	0.028	0.021	0.025	0.008
Orthophosphate, Dissolved	mg/l	0.012	0.006	0.02	0.023	0.021	0.023	0.008
Organic Carbon, Total	mg/l	1.3	1.4	1.5	1.4	1.3	1.4	1.1
Calcium	mg/l	16.1	15.4	59.7	18.6	12.6	13.8	7.06
Magnesium	mg/l	5.34	5.78	5.88	5.64	4.67	5.56	4.23
Chloride	mg/l	35	23	189	37	20	20	9
Sulfate	mg/l	<20	<20	<10	<10	<20	<20	<10
Turbidity	ntu	1.73	<1	1.7	<1	1.84	<1	1.95
Iron, Total	µg/l	95	102	221	142	122	104	195
Iron, Dissolved	µg/l	49	43	100	71	66	53	61
Manganese, Total	µg/l	24	30	38	37	32	27	17
Manganese, Dissolved	µg/l	20	30	36	29	31	24	<10
Aluminum, Total	µg/l	<200	<200	<200	<200	<200	<200	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams—Continued

Parameter	Units	LNGA 2.5	OCTO 6.6	OCTO 6.6	OCTO 6.6	OCTO 6.6	SBCC 20.4	SCTT 3.0
Date	yyyymmdd	19980803	19980805	19981106	19990211	19990428	19980803	19980805
Time	hhmm	1100	1300	945	935	1105	1315	900
Discharge	cfs	1.338	47.04	48.34	102.1	158.8	0.958	0.191
Temp	degree C	18.8	23.5	7	4.1	13.2	17.1	18.8
Conductance	umhos/cm	166	222	233	212	211	103	300
Dissolved Oxygen	mg/l	8.93	7.29	7.87	7.83	5.93	8.75	6.64
pH		7.15	7.7	7.6	7	7.45	7	7.4
Alkalinity	mg/l	30	44	42	46	44	32	54
Acidity	mg/l	6	2	4	6	6	4	4
Solids, Total	mg/l	133	399	100	164	188	68	164
Solids, Dissolved	mg/l	117		100	164	172	68	
Ammonia, Total	mg/l	0.04	0.06	<0.02	0.48	<0.02	0.03	0.08
Ammonia, Dissolved	mg/l	0.04	0.06	<0.02	0.46	<0.02	0.03	0.04
Nitrite, Total	mg/l	<0.01	0.01	0.01	0.04	0.03	<0.01	0.04
Nitrite, Dissolved	mg/l	<0.01	0.01	0.01	0.03	0.03	<0.01	0.03
Nitrate, Total	mg/l	6	5.21	5.48	5.06	5.57	1.69	2.68
Nitrate, Dissolved	mg/l	5.63	5.09	5.32	5.04	5.52	1.69	2.66
Phosphorus, Total	mg/l	0.087	0.02	0.04	0.29	0.07		0.088
Phosphorus, Dissolved	mg/l	0.012	0.018	0.025	0.227	0.02	0.01	0.088
Orthophosphate, Total	mg/l		0.016	0.016	0.235	0.029	0.014	0.111
Orthophosphate, Dissolved	mg/l	0.012	0.014	0.016	0.185	0.002	0.006	0.088
Organic Carbon, Total	mg/l	1.9	3.1	2.6	5.3	3.6	1.2	2
Calcium	mg/l	15.1	17.2	19.9	17.1	19.1	11.2	20.2
Magnesium	mg/l	5.57	9.83	9.47	8.47	9.43	3.11	10
Chloride	mg/l	14	16	16	17	15	6	44
Sulfate	mg/l	<10	18		<20	<20	<10	13
Turbidity	ntu	4.7	1.78	<1	11.8	3.28	1.89	1.31
Iron, Total	µg/l	282	120	82	480	345	170	181
Iron, Dissolved	µg/l	32	22	29	87	41	68	32
Manganese, Total	µg/l	35	18	18	70	57	12	63
Manganese, Dissolved	µg/l	28	15	18	60	14	10	36
Aluminum, Total	µg/l	247	<200	<200	335	<200	<200	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams—Continued

Parameter	Units	SCTT 3.0	SCTT 3.0	SCTT 3.0	SUSQ 10.0	SUSQ 10.0	SUSQ 10.0	SUSQ 10.0
Date	yyyymmdd	19981105	19990210	19990427	19980805	19981105	19990210	19990427
Time	hhmm	1110	1110	1210	1100	1305	1250	1325
Discharge	cfs	0.202	0.753	0.761	6,060	3510	54,900	71,800
Temp	degree C	6.4	4	10.5	28.8	14	5.3	13.8
Conductance	umhos/cm	346	414	290	260	393	188	192
Dissolved Oxygen	mg/l	3.35	6.98	7.15	5.18	5.61	8.02	6.87
pH		6.64	6.75	7.05	7.55	7.3	6.9	7.6
Alkalinity	mg/l	96	52	42	64	74	42	46
Acidity	mg/l	18	10	10	4	18	8	6
Solids, Total	mg/l	254	300	108	1375	250	174	154
Solids, Dissolved	mg/l	250	288	108	1095	250	174	154
Ammonia, Total	mg/l	0.11	0.29	0.06	0.22	0.11	0.1	0.03
Ammonia, Dissolved	mg/l	<0.02	0.29	0.06	0.22	0.05	0.09	<0.02
Nitrite, Total	mg/l	0.02	0.02	0.03	0.05	0.03	<0.01	0.01
Nitrite, Dissolved	mg/l	0.01	0.02	0.03	0.05	0.03	<0.01	0.01
Nitrate, Total	mg/l	0.43	3.08	2.17	1.21	1.48	1.49	0.91
Nitrate, Dissolved	mg/l	0.04	3.05	2.14	1.2	1.48	1.2	0.79
Phosphorus, Total	mg/l	0.17	0.04	0.05	0.02	0.05	0.05	0.05
Phosphorus, Dissolved	mg/l	0.049	0.036	0.039	0.015	0.024	0.023	0.018
Orthophosphate, Total	mg/l	0.04	0.022	0.029	0.016	0.029	0.019	0.026
Orthophosphate, Dissolved	mg/l	0.037	0.02	0.026	0.012	0.02	0.014	0.003
Organic Carbon, Total	mg/l	5.2	2.7	2.3	3.4	2.6	2.8	2.7
Calcium	mg/l	26.7		23	27.1	43.6	21	21.2
Magnesium	mg/l	13.1		11.3	7.84	15.4	4.77	5.84
Chloride	mg/l	46	62	44	15	27	15	14
Sulfate	mg/l	<10	51	26	33	63	28	29
Turbidity	ntu	4.3	2.08	<1	4.6	3.3	8.48	<1
Iron, Total	µg/l	1050		145	226	145	309	350
Iron, Dissolved	µg/l	254		68	<20	<20	64	77
Manganese, Total	µg/l	2110		30	159	60	97	134
Manganese, Dissolved	µg/l	2110		27	85	60	70	78
Aluminum, Total	µg/l	<200	<200	<200	<200	<200	<200	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams—Continued

Parameter	Units	SUSQ 44.5	SUSQ 44.5	SUSQ 44.5	SUSQ 44.5
Date	yyyymmdd	19980806	19981110	19990225	19990412
Time	hhmm	1230	1120	1345	1330
Discharge	cfs	5,690	4,430	27,200	89,200
Temp	degree C	29.9	18	5.4	11.7
Conductance	umhos/cm	330	425	211	167
Dissolved Oxygen	mg/l	8.07			
pH		9	8.1	7.2	7.2
Alkalinity	mg/l	62	84	40	40
Acidity	mg/l	0	0	2	4
Solids, Total	mg/l	60	306	196	194
Solids, Dissolved	mg/l		294	154	150
Ammonia, Total	mg/l	0.05	0.04	0.09	0.06
Ammonia, Dissolved	mg/l	0.05	0.04	0.09	0.06
Nitrite, Total	mg/l	<0.01	0.01	0.01	0.02
Nitrite, Dissolved	mg/l	<0.01	0.01	0.01	0.01
Nitrate, Total	mg/l	0.61	1	1.06	0.88
Nitrate, Dissolved	mg/l	0.6	1	1.05	0.87
Phosphorus, Total	mg/l	0.02	0.029	0.04	0.1
Phosphorus, Dissolved	mg/l	0.016	0.023	0.033	0.052
Orthophosphate, Total	mg/l		0.018	0.044	0.048
Orthophosphate, Dissolved	mg/l	0.016	0.013	0.032	0.031
Organic Carbon, Total	mg/l	3.5	2.6	2.1	3.2
Calcium	mg/l	30.7	44.2		18.1
Magnesium	mg/l	10.7	13.4		5.22
Chloride	mg/l	25	28	18	12
Sulfate	mg/l	50	66	38	25
Turbidity	ntu	1.65	1.03	4.52	<1
Iron, Total	µg/l	83	94		1830
Iron, Dissolved	µg/l	<20	52	84	92
Manganese, Total	µg/l	40.8	17.1		192
Manganese, Dissolved	µg/l	23.1	10.8	111	32.9
Aluminum, Total	µg/l	<200	<200		661
Aluminum, Dissolved	µg/l	<200	<200		

Appendix B

Organic Pollution–Tolerance and Functional Feeding Group Designations of Benthic Macroinvertebrate Taxa

Order	Family	Genus	Organic Pollution Tolerance Value	Functional Feeding Group Designation
Coleoptera	Dytiscidae	*Agabus*	5	P
		Hydroporus	5	P
	Elmidae	*Macronychus*	2	SC
		Optioservus	4	SC
		Oulimnius	5	SC
		Stenelmis	5	SC
	Gyrinidae	*Dineutus*	4	P
	Psephenidae	*Psephenus*	4	SC
		Ectopria	5	SC
	Ptilodactylidae	*Anchytarsus*	5	SH
Diptera	Athericidae	*Atherix*	2	P
	Ceratopogonidae	*Bezzia*	6	P
	Chironomidae	Chironomidae	7	CG
	Empididae	*Hemerodromia*	6	P
	Simuliidae	Simuliidae	6	FC
	Tabanidae	*Tabanus*	5	P
	Tipulidae	*Antocha*	3	CG
		Dicranota	3	P
		Hexatoma	2	P
		Pedicia	6	P
		Tipula	4	SH
Ephemeroptera	Ameletidae	*Ameletus*	0	CG
	Baetidae	*Acentrella*	4	CG
		Baetis	6	CG
		Centroptilum	2	CG
	Caenidae	*Caenis*	7	CG
	Ephemerellidae	*Eurylophella*	4	SC
		Serratella	2	SC
	Heptageniidae	*Epeorus*	0	CG
		Heptagenia	4	SC
		Leucrocuta	1	SC
		Stenacron	4	SC
		Stenonema	3	SC
	Isonychiidae	*Isonychia*	2	FC
	Leptophlebiidae	*Choroterpes*	2	CG
		Paraleptophlebia	1	CG
	Polymitarcyidae	*Ephoron*	2	CG
	Potamanthidae	*Anthopotamus*	4	CG
	Tricorythidae	*Tricorythodes*	4	CG
Hemiptera	Veliidae	*Rhagovelia*	8	P
Lepidoptera	Pyralidae	*Petrophila*	5	SC

Order	Family	Genus	Organic Pollution Tolerance Value	Functional Feeding Group Designation
Megaloptera	Corydalidae	*Corydalus*	4	P
		Nigronia	2	P
	Sialidae	*Sialis*	4	P
Odonata	Aeshnidae	*Boyeria*	2	P
	Gomphidae	*Gomphus*	5	P
		Ophiogomphus	1	P
		Stylogomphus albistylus	4	P
Plecoptera	Chloroperlidae	*Alloperla*	0	CG
		Sweltsa	0	P
	Leuctridae	*Leuctra*	0	SH
	Perlidae	*Acroneuria*	0	P
		Agnetina	2	P
		Attaneuria	3	P
		Eccoptura	2	P
		Neoperla	3	P
		Paragnetina	1	P
	Pteronarcyidae	*Pteronarcys*	0	SH
Trichoptera	Brachycentridae	*Brachycentrus*	1	FC
	Glossosomatidae	*Glossosoma*	0	SC
		Ceratopsyche	4	FC
		Cheumatopsyche	5	FC
		Hydropsyche	4	FC
		Macrostemum	3	FC
	Hydroptilidae	*Hydroptila*	6	SC
	Lepidostomidae	*Lepidostoma*	1	SH
	Philopotamidae	*Chimarra*	4	FC
		Dolophilodes	0	FC
	Polycentropodidae	*Polycentropus*	6	FC
	Rhyacophilidae	*Rhyacophila*	1	P
Oligochaeta: Haplotaxida	Naididae	Naididae	8	CG
	Lumbriculidae	Lumbriculidae	8	CG
Hirudinea: Gnathobdellida	Hirudinidae	*Helobdella*	6	P
Rhynchobdellida	Glossiphonidae	*Batrachobdella*	6	P
Crustacea: Amphipoda	Gammaridae	*Gammarus*	6	SH
Decapoda	Cambaridae	*Cambarus*	6	CG
		Orconectes	6	SH
Isopoda	Asellidae	*Caecidotea*	8	SH
Arachnoidea: Hydracarina	Hydracarina	Hydracarina	7	P
Gastropoda: Gastropoda	Physidae	*Physa*	8	SC
	Pleuroceridae	*Leptoxis*	6	SC
Bivalvia: Pelecypoda	Corbiculidae	*Corbicula*	4	FC
	Sphaeriidae	*Musculium*	8	FC
		Psidium	8	FC

Appendix C

Macroinvertebrate Data for Interstate Streams Crossing the New York-Pennsylvania and Pennsylvania-Maryland Borders

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams

Class: Order	Family	Family / *Genus*	SNAK 2.3	APAL 6.9	BNTY 0.9	CASC 1.6
Insecta: Coleoptera	Dytiscidae	*Agabus*				
		Hydroporus				
	Elmidae	*Macronychus glabratus*				
		Optioservus	1	17		
		Oulimnius				
		Stenelmis	3	40	3	
	Psephenidae	*Psephenus*	14	16	3	10
Diptera	Athericidae	*Atherix*	4			
	Ceratopogonidae	*Bezzia*	1			
	Chironomidae	Chironomidae	26	18	40	16
	Empididae	*Hemerodromia*	1		7	
	Simuliidae	Simuliidae		6		3
	Tabanidae	*Tabanus*				
	Tipulidae	*Antocha*	3			
		Dicranota				26
		Hexatoma	1	7	10	2
		Pedicia				
		Tipula				
Ephemeroptera	Ameletidae	*Ameletus*	2			
	Baetidae	*Acentrella*			2	
		Baetis	2	8		1
	Caenidae	*Caenis*	2			
	Ephemerellidae	*Eurylophella*				
		Serratella		2		
	Heptageniidae	*Epeorus*	5	1		
		Heptagenia				
		Leucrocuta			2	
		Stenacron				
		Stenonema	2	2	4	3
	Isonychiidae	*Isonychia*	1	7		3
	Leptophlebiidae	*Choropterus*				
		Paraleptophlebia	4		1	
		Habrophleboides				
	Tricorythidae	*Tricorythodes*				
Hemiptera	Veliidae	*Rhagovelia*				
Megaloptera	Corydalidae	*Corydalus*		1		
		Nigronia	3	2		5
	Sialidae	*Sialis*		1		
Odonata	Aeshnidae	*Boyeria*		1		
	Gomphidae	*Gomphus*				
		Ophiogomphus				
Plecoptera	Chloroperlidae	*Alloperla*				
		Sweltsa		4		
	Leuctridae	*Leuctra*	1	1	1	
	Perlidae	*Acroneuria*		1		4
		Agnetina		4		1
		Eccoptura	3			
		Neoperla			7	
		Paragnetina				

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Class: Order	Family	Family / *Genus*	SNAK 2.3	APAL 6.9	BNTY 0.9	CASC 1.6
Plecoptera	Pteronarcyidae	*Pteronarcys*				
Trichoptera	Brachycentridae	*Brachycentrus*				
	Glossosomatidae	*Glossosoma*				4
	Hydropsychidae	*Ceratopsyche*	12	14	30	11
		Cheumatopsyche	1	15		6
		Hydropsyche	3	3	3	7
	Lepidostomatidae	*Lepidostoma*				
	Philopotamidae	*Chimarra*	7	27		1
		Dolophilodes	6			30
	Polycentropodidae	*Polycentropus*	1			
	Rhyacophilidae	*Rhyacophila*				1
Crustacea: Decapoda	Cambaridae	*Cambarus*				4
Arachnoidea: Hydracarina	Hydracarina	Hydracarina				

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Class: Order	Family	Family / Genus	CAYT 1.7	CHOC 9.1	HLDN 3.5	LSNK 7.6
Insecta: Coleoptera	Dytiscidae	*Agabus*				
		Hydroporus				
	Elmidae	*Macronychus glabratus*				
		Optioservus	3	6		4
		Oulimnius			3	
		Stenelmis	10	7		
	Psephenidae	*Psephenus*	3	22	4	7
Diptera	Athericidae	*Atherix*	1	8	2	5
	Ceratopogonidae	*Bezzia*				
	Chironomidae	Chironomidae	9	24	14	28
	Empididae	*Hemerodromia*			7	
	Simuliidae	Simuliidae				
	Tabanidae	*Tabanus*				
	Tipulidae	*Antocha*				1
		Dicranota				
		Hexatoma		4	2	
		Pedicia				20
		Tipula				
Ephemeroptera	Ameletidae	*Ameletus*				
	Baetidae	*Acentrella*	2			
		Baetis	7	1	9	1
	Caenidae	*Caenis*	1		2	
	Ephemerellidae	*Eurylophella*				
		Serratella	3			1
	Heptageniidae	*Epeorus*	1	2		
		Heptagenia	2		2	
		Leucrocuta				
		Stenacron			1	
		Stenonema	18	1		1
	Isonychiidae	*Isonychia*	3	12	9	5
	Leptophlebiidae	*Choropterus*			1	
		Paraleptophlebia				
		Habrophleboides				
	Tricorythidae	*Tricorythodes*				
Hemiptera	Veliidae	*Rhagovelia*				
Megaloptera	Corydalidae	*Corydalus*				
		Nigronia	1		2	4
	Sialidae	*Sialis*				
Odonata	Aeshnidae	*Boyeria*				
	Gomphidae	*Gomphus*			1	7
		Ophiogomphus		2		
Plecoptera	Chloroperlidae	*Alloperla*		1		
		Sweltsa				
	Leuctridae	*Leuctra*		2		
	Perlidae	*Acroneuria*	1	3	1	6
		Agnetina			6	
		Eccoptura				
		Neoperla			1	
		Paragnetina				

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Class: Order	Family	Family / *Genus*	CAYT 1.7	CHOC 9.1	HLDN 3.5	LSNK 7.6
Plecoptera	Pteronarcyidae	*Pteronarcys*				1
Trichoptera	Brachycentridae	*Brachycentrus*				
	Glossosomatidae	*Glossosoma*				
	Hydropsychidae	*Ceratopsyche*	15	27	22	7
		Cheumatopsyche	11	6	2	8
		Hydropsyche		3	10	26
	Lepidostomatidae	*Lepidostoma*	2			
	Philopotamidae	*Chimarra*	3	11	1	11
		Dolophilodes			1	5
	Polycentropodidae	*Polycentropus*				
	Rhyacophilidae	*Rhyacophila*				
Crustacea: Decapoda	Cambaridae	*Cambarus*				
Arachnoidea: Hydracarina	Hydracarina	Hydracarina				

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Class: Order	Family	Family / *Genus*	NFCR 7.6	SEEL 10.3	SOUT 7.8	TROW 1.6
Insecta: Coleoptera	Dytiscidae	*Agabus*		1		
		Hydroporus	1			
	Elmidae	*Macronychus glabratus*	6			
		Optioservus			5	
		Oulimnius				
		Stenelmis		3	39	7
	Psephenidae	*Psephenus*	17	1	21	4
Diptera	Athericidae	*Atherix*	4		4	
	Ceratopogonidae	*Bezzia*				
	Chironomidae	Chironomidae	87	88	22	56
	Empididae	*Hemerodromia*	2	5		
	Simuliidae	Simuliidae			1	
	Tabanidae	*Tabanus*	2		1	
	Tipulidae	*Antocha*	3		1	1
		Dicranota	1			
		Hexatoma	5	7	5	6
		Pedicia				
		Tipula				
Ephemeroptera	Ameletidae	*Ameletus*	1			
	Baetidae	*Acentrella*	4			
		Baetis	9		3	15
	Caenidae	*Caenis*	1	1		
	Ephemerellidae	*Eurylophella*	1			
		Serratella				
	Heptageniidae	*Epeorus*				2
		Heptagenia				
		Leucrocuta				
		Stenacron		3		1
		Stenonema	5		2	1
	Isonychiidae	*Isonychia*		1	1	3
	Leptophlebiidae	*Choropterus*				
		Paraleptophlebia				1
		Habrophleboides	3			
	Tricorythidae	*Tricorythodes*		6		
Hemiptera	Veliidae	*Rhagovelia*				1
Megaloptera	Corydalidae	*Corydalus*				
		Nigronia	1			
	Sialidae	*Sialis*			1	
Odonata	Aeshnidae	*Boyeria*				
	Gomphidae	*Gomphus*				
		Ophiogomphus	1		2	
Plecoptera	Chloroperlidae	*Alloperla*				1
		Sweltsa				
	Leuctridae	*Leuctra*	6		1	
	Perlidae	*Acroneuria*				
		Agnetina	6			5
		Eccoptura				
		Neoperla				
		Paragnetina				

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Class: Order	Family	Family / *Genus*	NFCR 7.6	SEEL 10.3	SOUT 7.8	TROW 1.6
Plecoptera	Pteronarcyidae	*Pteronarcys*				
Trichoptera	Brachycentridae	*Brachycentrus*	1			
	Glossosomatidae	*Glossosoma*				2
	Hydropsychidae	*Ceratopsyche*	7	15	8	4
		Cheumatopsyche	6		6	3
		Hydropsyche	24		10	9
	Lepidostomatidae	*Lepidostoma*				
	Philopotamidae	*Chimarra*			11	
		Dolophilodes		1	1	28
	Polycentropodidae	*Polycentropus*	2			
	Rhyacophilidae	*Rhyacophila*				
Crustacea: Decapoda	Cambaridae	*Cambarus*				
Arachnoidea: Hydracarina	Hydracarina	Hydracarina				

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Class: Order	Family	Family / *Genus*	TRUP 4.5	WAPP 2.6
Insecta: Coleoptera	Dytiscidae	*Agabus*		
		Hydroporus		
	Elmidae	*Macronychus glabratus*	1	2
		Optioservus		6
		Oulimnius		
		Stenelmis		6
	Psephenidae	*Psephenus*	1	5
Diptera	Athericidae	*Atherix*	4	1
	Ceratopogonidae	*Bezzia*		
	Chironomidae	Chironomidae	56	20
	Empididae	*Hemerodromia*	3	1
	Simuliidae	Simuliidae		
	Tabanidae	*Tabanus*	1	
	Tipulidae	*Antocha*		
		Dicranota		
		Hexatoma	1	1
		Pedicia		
		Tipula		1
Ephemeroptera	Ameletidae	*Ameletus*		
	Baetidae	*Acentrella*	2	1
		Baetis	6	7
	Caenidae	*Caenis*		3
	Ephemerellidae	*Eurylophella*		
		Serratella		1
	Heptageniidae	*Epeorus*		7
		Heptagenia		
		Leucrocuta		1
		Stenacron		
		Stenonema		3
	Isonychiidae	*Isonychia*	4	19
	Leptophlebiidae	*Choroptera*		
		Paraleptophlebia		
		Habrophleboides		
	Tricorythidae	*Tricorythodes*		
Hemiptera	Veliidae	*Rhagovelia*		
Megaloptera	Corydalidae	*Corydalus*		
		Nigronia		3
	Sialidae	*Sialis*		
Odonata	Aeshnidae	*Boyeria*		
	Gomphidae	*Gomphus*		
		Ophiogomphus		
Plecoptera	Chloroperlidae	*Alloperla*		
		Sweltsa		
	Leuctridae	*Leuctra*		
	Perlidae	*Acroneuria*	1	
		Agnetina		
		Eccoptura		

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Class: Order	Family	Family / *Genus*	TRUP 4.5	WAPP 2.6
Plecoptera		*Neoperla*	8	
		Paragnetina		2
	Pteronarcyidae	*Pteronarcys*		
Trichoptera	Brachycentridae	*Brachycentrus*		
	Glossosomatidae	*Glossosoma*		
	Hydropsychidae	*Ceratopsyche*	27	24
		Cheumatopsyche	12	1
		Hydropsyche	4	6
	Lepidostomatidae	*Lepidostoma*		
	Philopotamidae	*Chimarra*	2	3
		Dolophilodes		
	Polycentropodidae	*Polycentropus*		
	Rhyacophilidae	*Rhyacophila*		
Crustacea: Decapoda	Cambaridae	*Cambarus*		
Arachnoidea: Hydracarina	Hydracarina	Hydracarina	2	1

Table C2. Macroinvertebrate Data for Pennsylvania-Maryland Border Streams

Class: Order	Family	Family / *Genus*	BBDC 4.1	CNWG 4.4	DEER 44.5	EBAU 1.5
Insecta: Coleoptera	Elmidae	*Optioservus*	34		29	11
		Oulimnius				19
		Stenelmis		24	17	1
	Psephenidae	*Psephenus*		1	7	2
		Ectopria				
	Ptilodactylidae	*Anchytarsus*	11			
Diptera	Athericidae	*Atherix*		6	6	
	Chironomidae	Chironomidae	11	16	10	21
	Empididae	*Hemerodromia*		1	2	2
	Simuliidae	Simuliidae		3	1	1
	Tipulidae	*Antocha*			4	4
		Dicranota				1
		Hexatoma				
		Pedicia				
		Tipula	1		1	
Ephemeroptera	Baetidae	*Acentrella*		1		
		Baetis	4	12	2	4
		Centroptilum				
	Ephemerellidae	*Serratella*		1	2	
	Heptageniidae	*Epeorus*	6		3	
		Heptagenia	1			
		Stenonema	3	27	9	1
	Isonychiidae	*Isonychia*	13	13	7	
	Leptophlebiidae	*Paraleptophlebia*				
Megaloptera	Corydalidae	*Corydalus*		6	1	
		Nigronia	5	2	3	
	Sialidae	*Sialis*				
Odonata	Gomphidae	*Gomphus*				
		Ophiogomphus	1			
		Stylogomphus albistylus				
Plecoptera	Leuctridae	*Leuctra*	7	3		5
	Perlidae	*Acroneuria*	2		2	2
		Agnetina	1		1	
		Eccoptura	4			
		Paragnetina				
Trichoptera	Hydropsychidae	*Ceratopsyche*	10	3	15	34
		Cheumatopsyche	2	21	19	5
		Hydropsyche	7	15		13
		Macrostemum				
	Hydroptilidae	*Hydroptila*				
	Philopotamidae	*Chimarra*				
		Dolophilodes	7		1	1
	Polycentropodidae	*Polycentropus*	2			
	Rhyacophilidae	*Rhyacophila*	3			
Oligochaeta: Haplotaxida	Lumbriculidae	Lumbriculidae			2	2
Hirudinea: Rhynchobdellida	Glossiphonidae	*Batrachobdella*				
Crustacea: Amphipoda		*Gammarus*				
Decapoda	Cambaridae	*Orconectes*				
Gastropoda: Gastropoda	Physidae	*Physa*				
Bivalvia: Pelecypoda	Corbiculidae	*Corbicula*		2		

Table C2. Macroinvertebrate Data for Pennsylvania-Maryland Border Streams—Continued

Class: Order	Family	Family/*Genus*	FBDC 4.1	LNGA 2.5	OCTO 6.6	SBCC 20.4
Insecta: Coleoptera	Elmidae	*Optioservus*	2	30		8
		Oulimnius	5			7
		Stenelmis	6	6	45	
	Psephenidae	*Psephenus*	1	1	6	
		Ectopria	1			
	Ptilodactylidae	*Anchytarsus*		5		
Diptera	Athericidae	*Atherix*				
	Chironomidae	Chironomidae	26	24	1	18
	Empididae	*Hemerodromia*		1		
	Simuliidae	Simuliidae			1	
	Tipulidae	*Antocha*	2	1		
		Dicranota				10
		Hexatoma	1	1		9
		Pedicia		3		
		Tipula	8			1
Ephemeroptera	Baetidae	*Acentrella*		1	4	
		Baetis	6	5	11	
		Centroptilum				4
	Ephemerellidae	*Serratella*			14	
	Heptageniidae	*Epeorus*				
		Heptagenia				
		Stenonema	6	1	14	6
	Isonychiidae	*Isonychia*				
	Leptophlebiidae	*Paraleptophlebia*				1
Megaloptera	Corydalidae	*Corydalus*				
		Nigronia	9			1
	Sialidae	*Sialis*			1	
Odonata	Gomphidae	*Gomphus*				1
		Ophiogomphus				
		Stylogomphus albistylus	1			
Plecoptera	Leuctridae	*Leuctra*	18	3		5
	Perlidae	*Acroneuria*				6
		Agnetina				
		Eccoptura	15			
		Paragnetina			1	
Trichoptera	Hydropsychidae	*Ceratopsyche*	3	7	6	8
		Cheumatopsyche	7	8	2	7
		Hydropsyche	10	16	2	20
		Macrostemum			19	
	Hydroptilidae	*Hydroptila*	1			
	Philopotamidae	*Chimarra*			7	
		Dolophilodes	2			12
	Polycentropodidae	*Polycentropus*	1			
	Rhyacophilidae	*Rhyacophila*				
Oligochaeta: Haplotaxida	Lumbriculidae	Lumbriculidae			2	
Hirudinea: Rhynchobdellida	Glossiphonidae	*Batrachobdella*				
Crustacea: Amphipoda		*Gammarus*			9	
Decapoda	Cambaridae	*Orconectes*		1		
Gastropoda: Gastropoda	Physidae	*Physa*				
Bivalvia: Pelecypoda	Corbiculidae	*Corbicula*				

Table C2. Macroinvertebrate Data for Pennsylvania-Maryland Border Streams—Continued

Class: Order	Family	Family / *Genus*	SCTT 3.0
Insecta: Coleoptera	Elmidae	*Optioservus*	
		Oulimnius	
		Stenelmis	
	Psephenidae	*Psephenus*	
		Ectopria	
	Ptilodactylidae	*Anchytarsus*	
Diptera	Athericidae	*Atherix*	
	Chironomidae	Chironomidae	54
	Empididae	*Hemerodromia*	
	Simuliidae	Simuliidae	
	Tipulidae	*Antocha*	
		Dicranota	
		Hexatoma	
		Pedicia	
		Tipula	
Ephemeroptera	Baetidae	*Acentrella*	
		Baetis	1
		Centroptilum	
	Ephemerellidae	*Serratella*	
	Heptageniidae	*Epeorus*	
		Heptagenia	
		Stenonema	
	Isonychiidae	*Isonychia*	
	Leptophlebiidae	*Paraleptophlebia*	
Megaloptera	Corydalidae	*Corydalus*	
		Nigronia	
	Sialidae	*Sialis*	
Odonata	Gomphidae	*Gomphus*	
		Ophiogomphus	
		Stylogomphus albistylus	
Plecoptera	Leuctridae	*Leuctra*	
	Perlidae	*Acroneuria*	
		Agnetina	
		Eccoptura	
		Paragnetina	
Trichoptera	Hydropsychidae	*Ceratopsyche*	
		Cheumatopsyche	
		Hydropsyche	
		Macrostemum	
	Hydroptilidae	*Hydroptila*	
	Philopotamidae	*Chimarra*	
		Dolophilodes	
	Polycentropodidae	*Polycentropus*	
	Rhyacophilidae	*Rhyacophila*	
Oligochaeta: Haplotaxida	Lumbriculidae	Lumbriculidae	30
Hirudinea: Rhynchobdellida	Glossiphonidae	*Batrachobdella*	
Crustacea: Amphipoda		*Gammarus*	
Decapoda	Cambaridae	*Orconectes*	
Gastropoda: Gastropoda	Physidae	*Physa*	15
Bivalvia: Pelecypoda	Corbiculidae	*Corbicula*	

Table C3. Macroinvertebrate Data for River Sites

Class: Order	Family	Family / Genus	SUSQ 289.1	SUSQ 340.0	CHEM 12.0	COWN 2.2
Insecta: Coleoptera	Elmidae	*Optioservus*	4			
		Oulimnius		2		
		Stenelmis	25	22	13	
	Gyrinidae	*Dineutus*			1	
	Psephenidae	*Psephenus*	15	9		
Diptera	Athericidae	*Atherix*	1			
	Chironomidae	Chironomidae	4	6	18	28
	Empididae	*Hemerodromia*				
	Simuliidae	Simuliidae				2
	Tipulidae	*Antocha*			1	
		Hexatoma				
Ephemeroptera	Baetidae	*Acentrella*	2		2	
		Baetis	5	4	2	
	Caenidae	*Caenis*			1	1
	Ephemerellidae	*Serratella*	4			
	Heptageniidae	*Heptagenia*		4		
		Stenacron		2		
		Stenonema	1	6	5	
	Isonychiidae	*Isonychia*	13	5	20	
	Leptophlebiidae	*Choropterus*		2		
	Polymitarcyidae	*Ephoron*	1	3		
	Potamanthidae	*Anthopotamus*		17		
Lepidoptera	Pyralidae	*Petrophila*			1	
Megaloptera	Corydalidae	*Corydalus*			2	
	Sialidae	*Sialis*		8		
Odonata	Gomphidae	*Gomphus*			1	
Plecoptera	Perlidae	*Acroneuria*				
		Agnetina	7	1		
		Attaneuria		1		
		Paragnetina				
Trichoptera	Brachycentridae	*Brachycentrus*		1		
	Hydropsychidae	*Ceratopsyche*	12	2	15	9
		Cheumatopsyche	7	2	13	11
		Hydropsyche	6		5	
		Macrostemum	3	10	3	
	Lepidostomatidae	*Lepidostoma*		1		
	Philopotamidae	*Chimarra*	15		4	
Oligochaeta: Haplotaxida	Naididae	Naididae		1		
	Lumbriculidae	Lumbriculidae				4
Hirudinea: Gnathobdellida	Hirudinidae	*Helobdella*	1			
Rhynchobdellida	Glossiphonidae	*Batrachobdella*			1	
Crustacea: Isopoda	Asellidae	*Caecidotea*				70
Gastropoda: Gastropoda	Physidae	*Physa*		1		
	Pleuroceridae	*Leptoxis*				
Bivalvia: Pelecypoda	Corbiculidae	*Corbicula*				
	Sphaeriidae	*Musculium*	2			
		Psidium		7	4	

Table C3. Macroinvertebrate Data for River Sites

Class: Order	Family	Family / Genus	SUSQ 365.0	TIOG 10.8	SUSQ 44.5
Insecta: Coleoptera	Elmidae	*Optioservus*			
		Oulimnius	1		
		Stenelmis	66		30
	Gyrinidae	*Dineutus*	1		
	Psephenidae	*Psephenus*	8		1
Diptera	Athericidae	*Atherix*	1	2	
	Chironomidae	Chironomidae	5	10	1
	Empididae	*Hemerodromia*		3	
	Simuliidae	Simuliidae	5	4	
	Tipulidae	*Antocha*		1	
		Hexatoma		1	
Ephemeroptera	Baetidae	*Acentrella*			18
		Baetis	5	2	17
	Caenidae	*Caenis*			
	Ephemerellidae	*Serratella*			1
	Heptageniidae	*Heptagenia*			
		Stenacron			
		Stenonema	1	11	8
	Isonychiidae	*Isonychia*	14	15	7
	Leptophlebiidae	*Choroptera*			
	Polymitarcyidae	*Ephoron*	6		
	Potamanthidae	*Anthopotamus*			
Lepidoptera	Pyralidae	*Petrophila*			1
Megaloptera	Corydalidae	*Corydalus*	1	3	1
	Sialidae	*Sialis*			
Odonata	Gomphidae	*Gomphus*			
Plecoptera	Perlidae	*Acroneuria*	6	1	
		Agnetina	17		
		Attaneuria			
		Paragnetina	4		
Trichoptera	Brachycentridae	*Brachycentrus*			
	Hydropsychidae	*Ceratopsyche*	5	34	2
		Cheumatopsyche	2	8	16
		Hydropsyche		20	6
		Macrostemum	4		9
	Lepidostomatidae	*Lepidostoma*			
	Philopotamidae	*Chimarra*	2	7	15
Oligochaeta: Haplotaxida	Naididae	Naididae	1		
	Lumbriculidae	Lumbriculidae			5
Hirudinea: Gnathobdellida	Hirudinidae	*Helobdella*			
Rhynchobdellida	Glossiphonidae	*Batrachobdella*			
Crustacea: Isopoda	Asellidae	*Caecidotea*			
Gastropoda: Gastropoda	Physidae	*Physa*			
	Pleuroceridae	*Leptoxis*	10		
Bivalvia: Pelecypoda	Corbiculidae	*Corbicula*			6
	Sphaeriidae	*Musculium*			
		Psidium		4	

Appendix D

Water Classification and Best Usage Relationships

New York:

The New York State water quality classifications are summarized from Water Quality Regulations for Surface Waters and Groundwaters, 6NYCRR Parts 700-705, effective September 1, 1991, New York State Department of Environmental Conservation, Division of Water, Albany, New York. Only classifications that are used in this report will be described in this section. The classes are as follows:

Class B: The best usage of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

Class C: The best usage of Class C waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

Class D: The best usage of these waters is fishing. Due to such natural conditions as intermittence of flow, water conditions not conducive to propagation of game fishery, or streambed conditions, the waters will not support fish propagation. These waters shall be suitable for fish survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

(T): Suffix added to classes where trout survival is an additional best use to the use classification.

Pennsylvania:

The Pennsylvania state water quality classifications are summarized from Water Quality Standards of the Department's Rules and Regulations, 25 Pa. Code, Chapter 93.3-5, effective August 1989, Pennsylvania Department of Environmental Resources, Division of Water Quality, Harrisburg, Pennsylvania. All surface waters must meet protected water uses for aquatic life (warm water fishes), water supply (potable, industrial, livestock, and wildlife), and recreation (boating, fishing, water contact sports, and aesthetics). Only classifications that are used in this report will be described in this section. The use classifications are as follows:

CWF - Cold Water Fishes: Maintenance and/or propagation of fish species including the family Salmonidae and additional flora and fauna, which are indigenous to a cold water habitat.

WWF – Warm Water Fishes: Maintenance and propagation of fish species and additional flora and fauna that are indigenous to a warm water habitat.

TSF – Trout Stocked Fishery: Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna that are indigenous to a warm water habitat.

MF – Migratory Fishes: Passage, maintenance and propagation of anadromous and catadromous fishes and other fishes that ascend to flowing waters to complete their life cycle. The MF designation is in addition to other designations when appropriate.

Maryland:

The Maryland State water quality classifications are summarized from Water Quality Regulations for Designated Uses, COMAR 26.08.02, Effective November 1, 1993, Maryland Department of the Environment, Annapolis, Maryland. All surface waters must protect public health or welfare; enhance the quality of water; protect aquatic resources; and serve the purposes of the Federal Act. Only classifications that are used in this report will be described in this section. The designated use classifications are as follows:

I-P – Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply: This use designation includes waters that are suitable for water contact sports; play and leisure time activities where individuals may come in direct contact with surface water; fishing; the growth and propagation of fish (other than trout), other aquatic life, and wild life; and industrial supply. The P designation indicates that the water source may be used as a public water supply.

III-P – Natural Trout Waters and Public Water Supply: This use designation includes waters that have the potential for or are suitable for the growth and propagation of trout, and capable of supporting self-sustaining trout populations and their food organisms. The P designation indicates that the water use may be used as a public water supply.

IV-P – Recreational Trout Waters and Public Water Supply: This use designation includes cold or warm waters that have the potential for or are capable of holding or supporting adult trout for put-and-take fishing; and managed as a special fishery by periodic stocking and seasonal catching. The P designation indicates that the waters may be used as a public water supply.

Appendix E

Statistical Trend Results by Parameter

Table E1. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Suspended Solids

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau	% Slope	Median	P	b	Tau	% Slope
Cayuta Creek	0.053	-6.358	-0.216	-3.807	167	0.021	-5.713	-0.304	96.976
Chemung River	0.524	-1.997	-0.067	-0.970	206	0.743	-0.802	-0.047	45.180
Conowingo Creek	0.621	1.001	0.068	0.603	166	0.229	1.842	0.150	-44.103
Cowanesque River	0.068	2.664	0.249	2.131	125	0.918	0.170	0.042	-5.314
Deer Creek	0.832	-0.250	-0.014	-0.184	136	0.123	-0.419	-0.174	NA
Ebaugh Creek	0.011	7.868	0.310	4.141	190	0.030	6.819	0.274	-28.385
Octoraro Creek	0.329	-1.556	-0.089	-0.895	174	0.769	-0.587	-0.055	-22.350
Scott Creek	0.198	-4.716	-0.169	-2.382	198	0.966	-0.419	-0.012	NA
Susquehanna River 10.0	0.614	-2.035	-0.071	-1.131	180	0.301	-2.179	-0.137	NA
Susquehanna River 44.5	0.869	1.701	0.028	0.895	190	0.364	-2.813	-0.133	61.039
Susquehanna River 289.1	0.190	-1.602	-0.158	-1.068	150	0.066	-1.896	-0.214	59.411
Susquehanna River 340	1.000	0.000	0.021	0.000	124	0.689	0.276	0.068	-19.969
Susquehanna River 365	0.323	-1.765	-0.112	-1.401	126	0.719	-0.284	-0.087	5.702
Tioga River	0.147	-2.004	-0.152	-1.412	142	0.548	-0.835	-0.086	12.100
Troups Creek	0.225	1.581	0.156	0.953	166	0.165	3.661	0.189	NA

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E2. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Ammonia

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau	% Slope	Median	P	b	Tau	% Slope
Cayuta Creek	<0.001	-0.002	-0.381	-8.325	0.030	0.062	-0.002	-0.245	28.697
Chemung River	0.022	-0.003	-0.235	-6.606	0.050	0.041	-0.003	-0.218	NA
Conowingo Creek	0.489	0.000	-0.074	0.000	0.050	0.944	0.000	0.009	-38.402
Cowanesque River	0.719	0.000	-0.049	0.000	0.060	0.408	-0.001	-0.135	32.389
Deer Creek	0.025	-0.002	-0.222	-5.637	0.035	0.864	-0.001	-0.023	6.959
Ebaugh Creek	0.009	-0.004	-0.261	-7.489	0.050	0.320	-0.002	-0.114	21.453
Octoraro Creek	0.008	-0.004	-0.268	-9.089	0.040	0.291	-0.001	-0.044	40.760
Scott Creek	0.126	-0.012	-0.191	-10.358	0.120	0.519	-0.006	-0.080	21.447
Susquehanna River 10.0	0.065	-0.002	-0.201	-2.639	0.080	0.659	-0.001	-0.064	5.504
Susquehanna River 44.5	0.052	-0.002	-0.215	-4.221	0.040	0.014	-0.002	-0.282	40.418
Susquehanna River 289.1	0.014	-0.003	-0.250	-6.023	0.050	0.051	-0.002	-0.204	NA
Susquehanna River 340	0.003	-0.002	-0.298	-4.757	0.035	0.004	-0.002	-0.308	42.668
Susquehanna River 365	<0.001	-0.002	-0.469	-8.322	0.030	0.007	-0.002	0.358	52.282
Tioga River	0.007	-0.003	-0.267	-5.466	0.060	0.042	-0.003	-0.229	NA
Troups Creek	0.325	0.000	0.114	0.000	0.030	0.131	0.002	0.194	NA

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E3. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Nitrogen

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau	% Slope	Median	P	b	Tau	% Slope
Cayuta Creek	0.106	-0.021	-0.173	-3.651	0.576	0.014	-0.030	-0.297	77.604
Chemung River	0.192	-0.013	-0.142	-1.674	0.752	0.647	-3.260	-0.051	20.641
Conowingo Creek	<0.001	0.193	0.429	2.640	7.290	<0.001	0.211	0.545	NA
Cowanesque River	0.142	-0.013	-0.196	-2.587	0.517	0.605	-0.007	-0.104	29.553
Deer Creek	0.054	0.053	0.216	1.133	4.662	0.051	0.049	0.220	NA
Ebaugh Creek	0.624	0.004	0.067	0.077	5.808	0.918	0.005	0.015	18.800
Octoraro Creek	0.013	0.118	0.271	2.232	5.274	0.032	0.083	0.225	NA
Scott Creek	0.049	0.073	0.248	3.486	2.094	0.053	0.059	0.244	-33.457
Susquehanna River 10.0	0.778	-0.003	-0.030	-0.273	1.242	0.084	-0.022	-0.217	NA
Susquehanna River 44.5	1.000	0.001	-0.001	0.036	0.922	0.843	-0.002	-0.046	5.609
Susquehanna River 289.1	0.001	-0.020	-0.331	-2.915	0.702	0.011	-0.018	-0.265	NA
Susquehanna River 340	<0.001	-0.019	-0.439	-3.624	0.531	0.001	-0.017	-0.346	NA
Susquehanna River 365	0.012	-0.016	-0.266	-2.598	0.603	0.365	-0.009	-0.100	NA
Tioga River	0.173	-0.007	-0.013	-1.409	0.528	0.246	-0.010	-0.133	NA
Troups Creek	0.896	0.000	-0.019	0.000	0.202	0.790	-0.001	-0.024	5.139

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E4. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Phosphorus

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau	% Slope	Median	P	b	Tau	% Slope
Cayuta Creek	0.004	-0.006	-0.295	-7.858	0.080	0.006	-0.006	-0.342	63.195
Chemung River	0.009	-0.003	-0.272	-5.142	0.065	0.019	-0.003	-0.262	85.211
Conowingo Creek	0.014	-0.004	-0.262	-5.562	0.080	0.029	-0.003	-0.241	NA
Cowanesque River	0.479	0.000	-0.081	0.000	0.030	0.121	-0.001	-0.222	52.421
Deer Creek	<0.001	-0.002	-0.462	-8.285	0.030	0.048	-0.001	-0.236	97.484
Ebaugh Creek	<0.001	-0.003	-0.388	-6.794	0.040	0.004	-0.003	-0.333	NA
Octoraro Creek	0.009	-0.005	-0.284	-6.233	0.080	0.068	-0.003	-0.228	44.962
Scott Creek	<0.001	-0.013	-0.565	-15.265	0.088	<0.001	-0.010	-0.410	NA
Susquehanna River 10.0	0.001	-0.002	-0.338	-4.898	0.050	0.091	-0.001	-0.211	-54.857
Susquehanna River 44.5	0.004	-0.003	-0.307	-5.709	0.060	0.005	-0.004	-0.318	NA
Susquehanna River 289.1	<0.001	-0.003	-0.384	-6.642	0.050	<0.001	-0.003	-0.411	NA
Susquehanna River 340	<0.001	-0.003	-0.410	-6.272	0.040	0.003	-0.002	-0.321	NA
Susquehanna River 365	<0.001	-0.002	-0.444	-6.239	0.040	0.001	-0.003	-0.393	54.010
Tioga River	0.076	0.000	-0.181	0.000	0.030	0.100	-0.001	-0.179	NA
Troups Creek	0.146	0.000	-0.149	0.000	0.030	0.197	-0.001	-0.010	NA

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E5. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Chloride

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau	% Slope	Median	P	b	Tau	% Slope
Cayuta Creek	0.561	-0.230	-0.064	-1.500	20.0	0.124	-0.434	-0.173	96.876
Chemung River	0.122	0.833	0.162	3.203	26.0	<0.001	0.757	0.385	-75.008
Conowingo Creek	0.001	0.167	0.312	1.046	16.0	0.002	0.166	0.332	93.567
Cowanesque River	0.786	0.000	0.020	0.000	10.0	0.215	-0.128	-0.117	23.008
Deer Creek	0.009	0.223	0.265	1.351	16.5	0.012	0.256	0.280	-63.851
Ebaugh Creek	<0.001	4.985	0.448	13.473	37.0	<0.001	4.856	0.424	-79.774
Octoraro Creek	0.014	0.126	0.251	0.898	14.0	<0.001	0.177	0.459	NA
Scott Creek	0.115	0.502	0.188	1.476	34.0	0.111	0.552	0.202	-85.363
Susquehanna River 10.0	0.681	0.000	-0.045	0.000	15.0	0.718	-0.072	-0.038	26.704
Susquehanna River 44.5	0.868	0.000	0.031	0.000	14.0	0.321	-0.070	-0.084	17.391
Susquehanna River 289.1	0.049	0.497	0.203	3.310	15.0	0.006	0.400	0.282	NA
Susquehanna River 340	0.162	0.118	0.147	1.176	10.0	0.179	0.107	0.144	-46.548
Susquehanna River 365	0.121	0.168	0.175	1.667	10.0	0.934	0.014	0.041	-10.359
Tioga River	0.250	-0.090	-0.120	-1.005	9.0	0.048	-0.167	-0.205	-97.434
Troups Creek	1.000	0.000	-0.003	0.000	12.0	0.790	-0.050	-0.028	-38.923

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E6. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Sulfate

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau	% Slope	Median	P	b	Tau	% Slope
Cayuta Creek	0.007	-1.096	-0.285	-4.568	24	0.014	-1.248	-0.291	-83.629
Chemung River	<0.001	-1.074	-0.350	-3.464	31	<0.001	-1.086	-0.385	NA
Conowingo Creek	0.391	-0.332	-0.110	-2.213	15	0.291	-0.301	-0.127	44.792
Cowanesque River	<0.001	-1.334	-0.497	-5.801	23	0.001	-1.207	-0.443	NA
Deer Creek	0.075	0.000	0.163	0.000	10	0.258	0.307	0.129	-74.179
Ebaugh Creek	0.260	0.000	0.100	0.000	10	0.410	0.010	0.095	22.777
Octoraro Creek	0.246	-0.214	-0.134	-1.019	21	0.161	-0.314	-0.143	NA
Scott Creek	0.029	-1.169	-0.250	-4.871	24	0.028	-0.941	-0.270	NA
Susquehanna River 10.0	0.059	-0.944	-0.201	-2.420	39	0.659	-0.245	-0.045	-36.292
Susquehanna River 44.5	0.446	-0.706	-0.088	-1.472	48	0.003	-1.237	-0.312	NA
Susquehanna River 289.1	0.161	-0.500	-0.152	-2.778	18	0.110	-0.475	-0.177	NA
Susquehanna River 340	0.735	0.000	-0.038	0.000	17.5	0.259	-0.325	-0.122	NA
Susquehanna River 365	0.360	-0.286	-0.090	-1.787	16	0.118	-0.613	-0.161	NA
Tioga River	<0.001	-2.307	-0.468	-5.768	40	<0.001	-2.041	-0.536	NA
Troups Creek	<0.001	-1.342	-0.431	-6.099	22	0.001	-1.264	-0.425	NA

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E7. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Iron

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau	% Slope	Median	P	b	Tau	% Slope
Cayuta Creek	0.004	-26.590	-0.308	-13.429	198	0.340	-7.408	-0.145	35.600
Chemung River	0.001	-31.683	-0.328	-11.563	274	0.013	-43.056	-0.263	72.883
Conowingo Creek	<0.001	-57.451	-0.448	-13.238	434	0.016	-28.462	-0.274	65.616
Cowanesque River	0.131	41.578	0.209	12.774	325.5	0.256	40.477	0.154	-34.908
Deer Creek	<0.001	-53.164	-0.539	-17.233	308.5	0.026	-20.625	-0.250	NA
Ebaugh Creek	<0.001	-53.407	-0.502	-16.821	317.5	<0.001	-27.944	-0.424	NA
Octoraro Creek	0.049	-32.986	-0.207	-7.463	442	0.394	-7.567	-0.062	-52.629
Scott Creek	<0.001	-74.142	-0.465	-18.239	406.5	0.001	-87.465	-0.386	NA
Susquehanna River 10.0	0.002	-47.000	-0.334	-9.671	486	0.071	-50.813	-0.232	38.742
Susquehanna River 44.5	0.001	-72.366	-0.369	-9.859	734	0.001	-50.974	-0.396	NA
Susquehanna River 289.1	<0.001	-53.987	-0.422	-19.350	279	<0.001	-50.955	-0.392	NA
Susquehanna River 340	0.003	-37.148	-0.314	-11.609	320	0.035	-47.369	-0.224	74.092
Susquehanna River 365	0.001	-33.227	-0.362	-12.105	274.5	0.011	-13.603	-0.329	NA
Tioga River	0.722	-4.215	-0.034	-1.405	300	0.638	10.375	0.054	NA
Troups Creek	1.000	-1.120	-0.015	-0.560	200	0.424	-6.851	-0.049	21.871

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E8. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Aluminum

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau	% Slope	Median	P	b	Tau	% Slope
Cayuta Creek	0.385	-0.788	-0.093	-0.789	100	0.383	-3.972	-0.124	23.055
Chemung River	1.000	0.000	0.004	0.000	229	1.000	0.035	0.000	-0.199
Conowingo Creek	0.003	-23.294	-0.315	-8.260	282	0.006	-28.346	-0.315	NA
Cowanesque River	0.105	34.223	0.204	11.389	300.5	0.148	45.331	0.198	-70.986
Deer Creek	0.175	-0.751	-0.143	-0.751	100	0.810	-1.347	-0.030	12.053
Ebaugh Creek	0.254	-0.790	-0.116	-0.790	100	0.160	-8.039	-0.159	NA
Octoraro Creek	0.348	-7.247	-0.095	-2.684	270	0.156	-9.893	-0.142	-43.003
Scott Creek	0.543	0.000	-0.079	0.000	100	0.329	-5.992	-0.117	79.130
Susquehanna River 10.0	0.315	-5.709	-0.116	-2.196	260	0.100	-11.580	-0.210	98.024
Susquehanna River 44.5	0.087	-16.436	-0.183	-4.914	334.5	0.240	-16.262	-0.156	NA
Susquehanna River 289.1	0.068	-10.248	-0.188	-5.694	180	0.003	-12.652	-0.312	NA
Susquehanna River 340	0.500	-1.070	-0.074	-0.637	168	0.314	-4.831	-0.109	23.656
Susquehanna River 365	0.157	-1.493	-0.139	-1.493	100	0.011	-11.979	-0.302	NA
Tioga River	0.126	10.660	0.167	4.316	247	0.005	14.447	0.298	-32.897
Troups Creek	0.965	0.000	0.013	0.000	190	0.722	2.275	0.082	-11.647

P - Tred Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E9. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Manganese

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau	% Slope	Median	P	b	Tau	% Slope
Cayuta Creek	0.026	-4.399	-0.234	-4.399	100	0.034	-9.914	-0.275	NA
Chemung River	0.339	-0.835	-0.097	-0.365	229	0.647	-3.260	-0.051	20.641
Conowingo Creek	<0.001	-26.558	-0.367	-9.418	282	0.004	-32.510	-0.332	NA
Cowanesque River	0.208	17.452	0.158	7.302	239	0.469	45.743	0.100	-39.828
Deer Creek	0.006	-2.894	-0.280	-2.894	100	0.515	-3.932	-0.076	NA
Ebaugh Creek	0.015	-3.834	-0.246	-3.835	100	0.036	-12.396	-0.235	NA
Octoraro Creek	0.053	-13.677	-0.205	-5.085	269	0.039	-19.837	-0.239	NA
Scott Creek	0.242	0.000	-0.149	0.000	75	0.248	-4.568	-0.145	32.406
Susquehanna River 10.0	0.315	-5.119	-0.116	-1.969	260	0.100	-11.432	-0.210	NA
Susquehanna River 44.5	0.021	-22.307	-0.263	-8.435	264.45	0.127	-22.877	-0.193	NA
Susquehanna River 289.1	0.002	-18.722	-0.318	-10.637	176	<0.001	-16.827	-0.384	NA
Susquehanna River 340	0.098	-3.444	-0.176	-2.050	168	0.170	-8.351	-0.147	43.731
Susquehanna River 365	0.007	-7.625	-0.275	-7.625	100	<0.001	-14.381	-0.404	NA
Tioga River	0.126	9.385	0.167	4.305	218	0.013	13.681	0.260	-18.096
Troups Creek	0.188	-9.479	-0.157	-6.538	145	0.594	-6.582	-0.040	11.779

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E10. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Water Quality Index

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau	% Slope	Median	P	b	Tau	% Slope
Cayuta Creek	0.561	-0.333	-0.064	-0.667	50	0.171	-1.088	-0.171	NA
Chemung River	0.234	0.445	0.120	0.730	61	0.234	0.431	0.128	NA
Conowingo Creek	0.312	-0.399	-0.124	-0.712	56	0.259	-0.485	-0.120	NA
Cowanesque River	0.029	2.101	0.283	4.289	49	0.079	1.749	0.223	NA
Deer Creek	0.009	-0.979	-0.278	-2.647	37	0.123	-0.419	-0.174	NA
Ebaugh Creek	0.021	0.778	0.242	1.572	49.5	0.069	0.549	0.205	NA
Octoraro Creek	0.348	-0.332	-0.080	-0.593	56	0.656	-0.207	0.032	82.765
Scott Creek	<0.001	-1.785	-0.488	-2.834	63	<0.001	-1.534	-0.443	NA
Susquehanna River 10.0	0.571	-0.165	-0.074	-0.318	52	0.718	-0.088	-0.046	-5.981
Susquehanna River 44.5	0.084	-0.504	-0.187	-1.029	49	0.012	-0.662	-0.270	NA
Susquehanna River 289.1	0.074	0.666	0.183	1.332	50	0.097	0.696	0.169	NA
Susquehanna River 340	0.283	0.428	0.115	1.128	38	0.234	0.501	0.128	-49.327
Susquehanna River 365	0.446	0.250	0.078	0.649	38.5	0.681	0.178	0.048	-17.645
Tioga River	0.212	0.594	0.134	1.142	52	0.552	0.168	0.078	NA
Troups Creek	0.603	0.569	0.089	1.627	35	0.329	0.768	0.170	NA

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available